MATERNAL BEHAVIOUR OF MARES AND THE CONDITION OF FOALS AFTER PARTURITION

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Abstract

Eighteen purebred Arabian mares and six Anglo-Arabian mares were observed during first 4 h after foaling in one of the leading Polish stud farms in two foaling seasons. The aim of the research was to analyze the behavior of mares and the condition of foals after parturition. Specific behavioral responses like licking, nuzzling, and touching a foal were identified as interactive activities supporting the process of creating the bond between the mare and the foal. The maternal behaviors started immediately after parturition and reached the biggest frequency in the first hour after foaling. The time spent by the mares on standing, resting, and eating has also been measured. The results of observations were compared in reference to mares’ breeds and statuses. Aggressive maternal behaviour, both normal and abnormal (perceived as aberration) was noticed. Foal’s condition after parturition was assessed on the basis of the first standing up, colostrum nursing, and meconium passing. On average, the foals made attempts to stand up in the 21st min after birth, and the first self-reliant getting up occurred in the 85th min. The share of time spent by the foals in the upright position increased with every hour. Furthermore, the time of the first colostrum nursing was associated with the first standing up. The duration of gestation influenced foals' colostrum nursing and meconium passing.

Key words: mare, parturition, maternal behaviour, foal condition.

Research on maternal behavior is conducted for a better understanding of mares’ needs after parturition (5). Pregnancy in mares lasts on average of 320-340 d. Parturition is a process consisting of a wide range of reflexes, lasting about 10-30 min. Subsequently, the postpartum period follows (14). The time after giving the birth is extremely important because of its impact on health and fertility of the mare, as well as an influence on the development of the foal (12). The strength of the attachment and social bond between the mare and her foal can be analysed through quantification of activities such as frequency and duration of nursing bouts, mutual grooming, elements of normal maternal aggression, and the prevalence of activities functioning to maintain proximity between the mare and the foal (20).

The time after parturition is a critical period for foals. At this time, body temperature, gas exchange, digestion, and elimination of metabolic products are determined (16). The neonatal behavior of foals consists of multiple behaviours aimed at achieving the fastest motor coordination (11). The course of the neonatal period directly influences the foals’ condition (12). Early detection of aberrations allows effective help and, thus, the successful development and rearing of a newborn horse, which is a prerequisite for gaining success in breeding (16).

The aim of the research was to assess the selected elements of the behavior of the purebred Arabian and Anglo-Arabian mares, and the condition of foals during the first four hours after parturition. It seemed justifiable to observe the formation of mother-foal bond in purebred Arabian mares because in this breed maternal behavior of poor quality has been reported (8).

Material and Methods

The observations of the maternal behavior of mares and the condition of neonates were carried out during two foaling seasons, in one of the leading Polish stud farms in 2009-2010. Eighteen purebred Arabian and six Anglo-Arabian mares and their foals were observed. Among the observed mares, eight were primiparous and 16 were multiparous. Observations started when symptoms of the coming parturition, such as anxiety, walking around the box, frequent defecation, and sweating were noticed. Each mare was given help during the parturition. After the appearance of neonate’s hooves, the amniotic membrane was manually ruptured.
and the foal was pulled with the contractions. When the natural separation of the umbilical cord occurred, foal's umbilicus was disinfected. A number of different forms of postpartum behaviour were taken into account: mare - licking and sniffing the foal, lying, feeding, manifesting aggressive behaviour; foal - raising its head after parturition, positioning itself on sternum, attempts to get and stand up, time attached to teat, and passing meconium. Aggressive maternal behaviour has been divided into three categories: normal maternal aggression directed towards people and the neighbouring mares associated with protecting the process of a mare-foal bond formation, aggressive behaviour while nursing and abnormal aggression directed towards neonate.

The analysis included a 4 h-period after birth. One observer was located next to the wall of the box. During the research, the duration and frequency of certain mare's and foal's activities were measured by a stopwatch.

The average time spent by the mare and her foal on performing each activity was calculated and expressed as a percentage share of the entire time at which observations were conducted, perceived as 100%. Pearson correlation coefficients between the measured characteristics were determined. A computer programme for statistical analysis, Statistica 6.0 (StatSoft PL), was used. The significance of the differences between the means was verified using Student's t-test.

Results

The average length of pregnancy in the examined mares equalled 334 d. Primiparous mares foaled, on average, one day later than multiparous. The length of pregnancy in purebred Arabian mares was, in turn, about 3 d shorter than in Anglo-Arabian. The average time of passing placenta after parturition was 54 min. In the group of mares having a foal for the first time, a positive (r=0.73) correlation between the length of the pregnancy and the time of passing the placenta was noticed.

More than half of the mares began licking the newborn foal from its head and muzzle. The mares spent on average 9% of the observation time on sniffing the foal. Sniffing was the most intense in the first and second hour after the birth (11% and 12%, respectively), and decreased during consecutive hours to 6% of the time (Fig. 1). Differences in the time devoted to sniffing were found between the primiparous and multiparous mares. The mares giving birth for the first time were smelling their foals for 17% of the time, while multiparous only for 5%.

Licking the foals occupied an average of 12% of the time. Foals were being licked the longest time at the first hour after birth; the mean for all mares was 20 min (Fig. 1). A negative correlation (r= -0.61) between the time reserved for sniffing the foal at the first hour after the birth, and the time devoted to licking the neonate by the mare was noticed. It was observed that the primiparous mare, which demonstrated the aggressive behaviour towards the foal at the first minutes after birth, spent the most time during the first hour after parturition on licking the foal. Other primiparous mares, in turn, displaying the normal maternal behaviour, did not lick the foal at all. Instead, the mare devoted the entire first hour after the birth to sniffing the newborn foal.

![Graph](image)

Fig. 1. The percentage share of the time devoted by the mares to sniffing, licking the foal, lying and feeding in consecutive hours after the parturition.
Except for one primiparous mare, which remained in vertical position during parturition, other mares gave births lying. At the first hour after the birth, the mares spent an average of 19 min on lying (Fig. 1). The Arabian mares were laying in the first hour for 29% of the time, while the Anglo-Arabian did so for 43% of the time. In the next hours, the time devoted to lying declined significantly and averaged from 2% to 6% for all mares.

Mares were eating hay an average of 13% of the observation time. The share of the feeding time was increasing with every hour (Fig. 1). The primiparous mares spent the shortest time on feed intake during the first hour (only 2%); however, in the next hours, this share grew from 11% to 16%.

In the majority of purebred Arabian and Anglo-Arabian mares, the elements of normal maternal behaviour were observed. The only maternal behaviour disorder was noted in Arabian mare, which foaled for the first time. Forthwith parturition, after short sniffing the newborn foal, the mare attacked the foal. Thanks to the agile reaction of the staff, the neonate was separated from its mother. After a while, when the dam calmed down, an attempt to get the newborn horse closer to its mother was made. The mare began to lick the foal and the further process of the mother-foal bond formation proceeded normally.

The average weight of neonates was 44.0 kg. The Arabian foals weighed on average 40.5 kg while the Anglo-Arabian foals - 54.3 kg. No correlation between weight and foal’s behaviours after parturition was found. The foals made attempts to stand up on average in the 21st min after birth, and the first self-reliant getting up occurred in the 85th min (Table 1). Most foals rose on their feet before the end of the first hour after birth. The share of time spent by the foals in the upright position

![Fig. 2. The dispersion graph and the quality of the correlation coefficient between the length of gestation and the time of the first colostrum nursing by foals for all mares.](image)

### Table 1

Characteristics of some foal’s behaviours after parturition (mean and standard deviation)

<table>
<thead>
<tr>
<th></th>
<th>Raising a head (min)</th>
<th>Positioning on sternum (min)</th>
<th>Attempt to stand up (min)</th>
<th>First standing up (min)</th>
<th>First nursing (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1.33±0.56</td>
<td>1.79±0.84</td>
<td>21.38±13.91</td>
<td>85.17±40.58</td>
<td>129.46±34.19</td>
</tr>
<tr>
<td>Arabian foals</td>
<td>1.33±0.49</td>
<td>1.67±0.69</td>
<td>21.00±13.45</td>
<td>76.78±34.61</td>
<td>128.44±28.69</td>
</tr>
<tr>
<td>Anglo-Arabian foals</td>
<td>1.33±0.82</td>
<td>2.17±1.17</td>
<td>22.50±16.5</td>
<td>110.33±49.87</td>
<td>132.50±50.63</td>
</tr>
<tr>
<td>Foals from primiparous</td>
<td>1.50±0.63</td>
<td>2.06±0.85</td>
<td>18.94±10.17</td>
<td>87.13±43.57</td>
<td>129.63±31.96</td>
</tr>
<tr>
<td>Foals from multiparous</td>
<td>1.00±0.0</td>
<td>1.25±0.46</td>
<td>26.25±19.32</td>
<td>81.25±36.27</td>
<td>129.13±40.65</td>
</tr>
</tbody>
</table>

a,b values differ significantly at P<0.05 (refer to difference between primiparous and multiparous mares).
increased with every hour. The foals remained standing in the first hour for an average of 4% of the time, which was the shortest period of the observation time. The foals from multiparous mares, during the first hour, were standing almost two times longer than the foals born by primiparous mares. In the next hours, this trend was reversed and the foals from primiparous mares devoted to standing from 1% to 20% of the time more than the foals from multiparous mares. During the first two hours after birth the share of the time spent in upright position was higher in purebred Arabian foals than in foals born by Anglo-Arabian mares; in the consecutive hours these values were equalised.

Most foals received colostrum for the first time in the second and third hour after birth. The earliest colostrum nursing occurred in the 59th min after birth (Table 1). The relationship between the foals' first standing up and first colostrum collection was noticed. There was a positive correlation (r = 0.49) between these factors. Five foals passed meconium within 2 h after birth. Eight foals passed meconium between the 120th and 180th min after birth. Most of the foals (11) passed stool 3 h after birth. On average, meconium was passed two times.

A correlation between the length of gestation in mares and some adaptive reflexes in foals after birth was noticed. The longer the period of pregnancy in mares was, the sooner the foal received the colostrum (r = -0.45) (Fig. 2). There was also a positive correlation (r = 0.42) between the length of pregnancy and the time of passing meconium in all mares.

**Discussion**

The gestation in mares lasted on average 334 d, with fluctuations between 316 and 348 d. The results are entirely consistent with previous research of Tischner et al. (18), which indicated 334 d as the average length of pregnancy in 40 mares of different breeds. The research on the purebred Arabian mares showed that the average duration of gestation in mares of this breed was 340 d (19). In turn, the observation of Anglo-Arabian mares revealed that an average length of pregnancy was 328 d (17). In the crossbred pony mares, colt foals were carried 4 d longer than fillies and the length of gestation was 339 d (10).

Statistics shows that the majority of parturitions take place between 8 pm. and 1 o'clock in the morning. During this time, the activity of the brain cortex decreases and its inhibitory effect on subcortical centers grows weak, which has a positive impact on the parturition (14). Mares are able to prolong or even interrupt the first stage of the delivery when adverse conditions occur (3). Every third of the examined mares foaled during the day, between 6:00 am and 8:00 pm. Different results were presented by Krupa (11), who observed that in purebred Arabian mares all deliveries took place between 7.00 pm and 5.00 am. Observations of Tischner et al. (17) also mention only one mare, which foaled in antemeridian hours. In later research of Tischner et al. (18), only two out of 40 mares foaled during the day.

Postpartum maternal behaviour begins immediately after parturition and consists of the following activities: nuzzling, licking, grooming, avoiding stepping or laying on the newborn, enabling and giving assistance with suckling, protecting the foal from potential danger by positioning itself between the infant and the hazard, and even attacking and repelling the intruder. These behaviours are the most intense in the first hours. Subsequently, the frequency of such behaviours falls during the first three days of the neonate's life, until a particular bond between the mare and her foal is stabilised (6). The mare's attachment to her foal is formed within the first few hours after parturition, while the formation of a bond linking the foal to its mother takes place after a few days (2, 8). After maternal imprinting, a mare usually rejects attempts at suckling displayed by any other foal (4).

The first interaction between mare and foal is examining the newborn's head. This reaction resembles the greeting behaviour of two adult horses (8). Another reaction of mare can be licking her own body and limbs or eating hay or straw (3). Almost all of the observed mares began sniffing and licking the newborn shortly after parturition, even before they raised themselves up. Similar behaviours were observed in thoroughbred mares (13). Thirteen out of 24 mothers began licking from the foal's nostrils and muzzle, four from shoulder blades, three from legs and only two from the perianal area. These results are consistent with the previous observations (13). Chavatte (3) in turn, claims that mare concentrates on licking the navel and the perianal area. The intense anus licking may intend to facilitate the foal to pass meconium (13). A mare can display interest in the amniotic fluid and discarded membranes as well but in contrast to other species domesticated horses rarely eat placenta (3, 6).

An extremely important activity in the process of the foal identification is licking the newborn by the mother. Licking dries foal's outer coat, stimulates blood circulation, stimulates the foal to breathe and encourages activity (8). In the case of observed horses, mares devoted an average of 12% of the time on licking the neonate. Foals were being licked the longest time during the first hour after parturition; the average for all mares was 34% of the time. The frequency of licking decreased significantly with time, but it did not cease completely. Arabian mares spent on average 7% of the time in a twelve-hour observation period on licking and sniffing (11); thoroughbred mares, in turn, spent 51% during six hours after parturition on doing so (13). Both purebred and thoroughbred mares were licking foals for the longest time in the first hour after labour. In the following hours, the frequency of this behaviour decreased (11, 13). Both the long period of licking the foal and the rapid disappearance of this behaviour over time allow understanding how important the sense of taste is in the process of identification of the newborn (8).

No correlation between the time spent on licking and sniffing the foal and age, status or race of the
dam was found. Neither was such a relationship discovered by other authors (11, 13). In the research of Krupa (13), the most of the time devoted to licking and sniffing the newborn was noticed in the primiparous mare. The author claims that neither age nor status of a mare, nor sex of a foal affects the intensity of licking. The decreased interest in a neonate may be caused by postpartum disorders.

In the first hour after parturition, the observed mares spent an average of 32% of the time on lying. This period decreased over hours, and in the last hour it measured less than 2% for all mares. The values are similar to those reported for purebred Arabian mares (11), and much higher than the ones observed in thoroughbred mares (13).

Another activity undertaken by mares was eating. During the whole observation period, the mares spent on average from 7 to 9 min on performing this task. This value is similar to time noted in the purebred Arabian mares within twelve hours of the observation (11). Thoroughbred mares spent nearly twice as much time on eating (13). Average share of the time spent on eating increased with every hour for all mares. The same correlation was observed by Krupa (11).

Some manifestations of aggressive behaviour have been observed, but in most cases they expressed normal maternal behaviour. Aggressive behaviour was displayed by sharply pinned backwards ears, head shaking, showing teeth, and kicking with hind leg. As in thoroughbred mares, these activities were accompanied by circling around the foal and sniffing it (13). Such behaviours are intended to protect the process of bond formation between mother and her neonate (8). The aggression was observed in 19% of multiparous and 50% of primiparous mares. In four mares, aggression was directed towards the neighbouring mares. Boxes in the stud where the research has been carried out were specially prepared for the time of parturition and had walls instead of bars in order to limit the contact of dams with neighbouring mares. Aggression directed to people was observed in two mares. These signs of aggression were manifested by pinning ears back and shaking head. This type of aggression is also a part of normal maternal behaviour, which makes a mare repel an intruder, who could pose a threat to the process of mare-foal bond formation (6).

It was observed that some mares led their foals to the udder and encouraged suckling. Almost all of the observed mares pulled abdomen or even lifted hindquarter when neonate was seeking teats. In the research, 44% of multiparous and 25% of primiparous positioned themselves to allow easy access to the udder or even pushed the foal by the head in this direction. The similar behaviour was observed in thoroughbred mares (13). Among the observed mares, 6% of multiparous and 38% of primiparous were aggressive towards foals while nursing. This moderate aggression included head threats, swishing the tail, and pushing the foal with the head. Foals usually do not respond to this kind of maternal aggression (1, 6). This type of mare’s behaviour may be associated with pain in the udder. Carson and Wood-Gash (2) suggest that nursing is most painful for mares between 2 and 3 weeks after foaling. An interesting case of maternal rejection was reported by Houpt and Antczak (9). A donkey mare was kicking and biting her neonatal foal because of agalactia. The lack of milk was caused by dehydration. But the primary cause of this problem was neophobia. The water was presented in a new container and donkey mare was avoiding the neonate (9).

Many mares step away from the neonate while it is seeking the teats, even before nursing. That behaviour was observed in both feral and domestic mare and foal pairs (6). The rejection behaviour teaches neonate to follow its dam (6, 8). Horses were classified as ‘followers’ because they can follow a dam and travel with the herd soon after birth (2). The rejection behaviour is important because the following response of the foal is indiscriminate at first, so it is able to follow any large moving object (7).

All of the observed neonates showed no symptoms of disease. Every foal raised its head after parturition and positioned itself on sternum within 4 min. On average, the foals made attempts to stand up after 21 minutes. Similar results were presented by Houpt (7) and Krupa (11). The observed foals produced by multiparous mares tried to stand up as early as 19 min after parturition, whereas the foals from primiparous did so 7 min later. During the first hour after labour, the foals made on average four attempts of getting up.

The first attempts of foals to stand up occurred on average in the 85th min after delivery. The similar time has been reported by Tischner et al. (18). Purebred foals rose on their feet on average 134 min after parturition (11). The observations of Anglo-Arabian mares showed that the time before the first getting up in this breed is much shorter - on average 43 min with fluctuations between 25 and 75 min (17). Cross-bred pony foals could stand up in 32nd min (10). In general, foals are able to rise within the first hour after parturition (7). The earliest standing up in the observed pure-bred Arabian foals occurred after 28 min, in Anglo-Arabian neonates after 49 min. The last getting up in the pure-bred Arabian foal was noted after 140 min and in Anglo-Arabian newborn after 174 min. The majority of foals (9) rose on their feet within the first hour after labour. Pruski et al. (14) reported that the shortest time after which standing up occurred was observed in the Anglo-Arabian foal (5 min after delivery), the longest time to get up was taken by the thoroughbred foal (165 min). The Arabian foals stood up as early as 77 min after delivery, whereas cross-bred neonates did so no sooner than in the 110th min. During the second hour, the abilities to walk, stand up, and lie down were improved (7).

After adapting an upright position, the foals sought the mare’s udder, approaching the front of her body and following along the horizontal abdomen line in the direction of the teats, with or without the dam’s help. Similar behaviours have been observed by other authors in case of foals from Anglo-Arabian mares (17). When a foal is seeking the udder, it follows along any horizontal ledge, because under natural condition it would be only
the mare’s abdomen. This explains why foals in stalls and paddocks may follow along fences or other horizontal feature (6). Prior to the delivery, foals receive no passive transfer of immunity via the placenta, so the earliest colostrum intake is crucial for their health (15). In the research, the first suckling occurred on average in 129 min after parturition, with fluctuations from 59 and 200 min. A similar result has been noted by Tischner et al. (18) - 132 min with fluctuations from 60 to 185 min. In previous research of Tischner et al. (17), the time that had passed from parturition to suckling was 90 min, with fluctuations between 45 and 125 min. Krupa (11) in turn, claims that Arabian foals nurse for the first time after 184 min. from the delivery (from 95 to 404 min). Pony foals were observed to suckle no sooner than 65 min after parturition (10). In the case of 76% of the thoroughbred foals that were examined in the stud, the intake of colostrum followed after 100 min (14). The duration of nursing bout in thoroughbred foals was on average 147 min during the first week after parturition (2).

The obtained results of correlation between the foals’ first standing up and earliest colostrum intake seem to confirm the thesis about the influence of the rapidity of getting up on the time of the first suckling (11). The frequency of colostrum intake in foals of both breeds has also been measured. During a four-hour observation, foals drank colostrum 10 times on average. The frequency of colostrum intake rose over time. Colts took colostrum on average 9 times, whereas fillies did so 11 times. Thoroughbred foals were found to nurse, on average, seven times an hour (2). In fact, suckle bout duration and suckle bout frequency are not significantly related to the amount of milk energy intake the foal is receiving (4).

Foals are able to defecate within 30 min after parturition (7). Usually, the first attempts to pass meconium occur after the first intake of colostrum – normally it happens after 1-2 h after the first nursing (17). Twenty-five percent of the observed foals passed stool before the first intake of colostrum. In studies on Anglo-Arabian foals an average time of expelling meconium was 6.2 h (1.5 to 10 h) (17). The pony foals were reported to pass meconium at the 145th min after parturition (10). On the other hand, Krupa (11) stated that the average time of expelling the faeces in pure-bred foals was 164 min.

In conclusion, the problem of caring for mares and neonates is becoming increasingly important because foals are often of great value. Observation of the behaviour of mares and foals in postnatal period in a particular environment gives an understanding of their social needs and allows us to provide them with optimal living conditions by eliminating negative stress factors.

References