



Analytic Study of Maternal Behaviour in Arabian Mares

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Abstract

THE STUDY was conducted on 30 pregnant Arabian mares from El Zahra Arab Stud in Egypt and aim of this study is complete analysis of maternal behavior in mares and studying the factors affect the gestation length also analysis of some hormones related to maternal behavior. For each mare the gestation length (GL) and circadian rhythm of foaling were recorded. Obtained results revealed that the gestation length recorded 317 to 338 days with an average of 327 d, there was a difference in (GL) between multiparous (327.5d) and primiparous (324 d) and male (319.5 d), female (327.5d), foaling time was recorded 70 % of mares foaled AM at 14.00 to 17.00 hours, and 30 % of mares give birth PM at 3.00 to 9.00 hours.

The three stages of parturition were analyzed by direct observation and by video tape analysis. Blood sample were taken directly after parturition and subjected to hormonal assay for progesterone and prolactin analysis.

Mare - foal relationship was thoroughly investigated (smelling, licking, nursing, and vocalization). Maternal behavior revealed that latency of time of mother to first contact with foal, first lick and first feeding was 10,50, 12 and 16,44 minute post partum respectively. the umbilical cord was cut after standing of the mare 12 minute pp. Foal behavior recorded latency of time to first attempt to stand, successful standing, first suckle and passing of meconium within 5.15 m, 105, 110, 12 minute postpartum respectively. Suckling bout and Frequency of suckling recorded (time / hour) during first 24, 48, 72, 96, 120 hour respectively.

Keywords: Gestation length (GL), Foaling time, Stages of parturition, Foal behavior, Hormones.

Introduction

There are a variation in gestation length in mares but generally it lasts about 340 days, However, it can range from 320 days to 370 days. it has been shown that some mares can carry their foal for over a year. But generally after 315 days, mares should be observed closely because it can foal any day after that and If the foal is born before 315 days, the foal is considered premature and less than 300 days, it will mostly not survive [1]

The timing of parturition can be determined by genetic and environmental factors with the majority of mares (86%) tend to foal between 19.00 and 07.00 hours at night [2]

parturition is the process of giving birth when a foal is rapid growth and become uncomfortable in the dam's uterus. The foal produces adrenal

corticotrophin that stimulating the adrenal gland of mare to produce cortisol. Cortisol reduces progesterone levels, by synthesis of enzymes that convert progesterone to estrogen. As progesterone levels decrease, the myometrium contracts, and the uterus and placenta release prostaglandin alpha, leading to the breakdown of the corpus luteum and parturition has been begun [3]. there are three stages of parturition, the first one is contraction phase that accompanied by restlessness of mares and sweating, signs of colic, teat milking and switching to tail frequently. it last from 1 to 4 hour and terminate with rupture of chorioallantoic membrane, the second stage is expulsion phase that start with rupture of the chorioallantoic membrane and accompanied by restlessness, urination and defecation continuously and lateral recumbency with extension to four legs due to strong contractions, it lasts from 20 to 30 minutes and terminate with foal delivery, the last stage is placental expulsion that last from 2 to 3 hour

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whereas more than 3 hours it is considered retained placenta [4,5]

The maternal behavior is that behavior exhibited by mothers toward their young starting from parturition till weaning and determined by some observed behaviors, such as the licking, grooming, nursing and the time spent in contact with her newborn [6]

Among animals, the mother-offspring bond is one of the most important social relationships and are classified into 2 strategies : followers and hiders. Horses are classified as followers and nursing is very frequent, occurring about 4 to 5 time per hour during day time in the first week and gradually decreasing in frequency over subsequent weeks and months [7]

Maternal recognition and acceptance of the foal is particularly important in the first 12 hours as normal foals begin consuming the colostrum that contains immunoglobulins (maternal antibodies) [8]

Maternal behavior is influenced by some hormones as prolactin and progesterone whereas the prolactin affect the lactogenesis process by stimulating the mammary gland development in addition, participate in parturition of mare as it reach the highest level before parturition and within first 2-3 day after foaling. if prolactin secretion become low it may cause less development of mammary gland and consequently low maternal behavior [9]

Progesterone can affect on maternal expression and regulate the lactogenesis, in addition stimulate the mother brain to be sensitive for foal signals [10]. Rise in progesterone level before parturition is associated also with development of the mammary gland while the decline is accompanied with an increase in fetal cortisol and beginning of foaling [11]

It has been shown that maternal behavior is very important and represent atopic of study specially in mares so the aim of this study is complete analysis of maternal behavior beginning from gestation till parturition and foal recognition and acceptance, also analysis of some hormones after foaling that related to maternal behavior.

Material and Methods

Animals and Management

This study was conducted with approval of the veterinary Institutional of Animal Care and Use Committee (IACUC vet cu 01122022622). 30 pregnant Arabian mares (9 primiparous (pp) and 21 multiparous (MP)) from El-Zahra Stud Station were subjected to this study between January 2021 to September 2023, for each mare we recorded individual data (age of the dam (year), body weight (kg), parity and sex of foal (colt, filly).

Management protocol included feeding on concentrates mixture (barley) and good quality alfa alfa hay with mineral / vitamin supplement, pregnant mares housed in yard and were normally kept separate from other group of mares before foaling by 3 to 5 days. Mares were subjected to vaccinated program of Herpes (pneumoabort) at the recommended 5, 7 and 9 month of gestation and after parturition both mares and foals received Antitetanic serum.

Data collection

Data were recorded by direct observation and by video tape analysis through camera fixed in the loose box for study of different stages of parturition.

Measurements

1. Gestation length (GL): The period of gestation were determined by the time between the last day of mating till day of foaling [1]
2. Time of foaling : the circadian rhythm of foaling in mares were distributed all over the 24 hour of the day. [12]
3. The parturition stages : were divided to three stages according to [5] and were measured by time as follow:
 - prepartum period was measured from time of stress till rupture of chorioallantoic sac
 - Partum stage extended from rupture of sac to complete delivery of foal
 - postpartum period extend from delivery till expulsion of placenta

Behavioral Measures

For each of the previous stage of parturition, behavioral changes occurred on the dam was recorded. In prepartum stage we recorded signs of pain represented by :

- . looking at flank
- . moving back and forth
- . vocalization
- . kicking in ground
- . frequent urination and defecation
- . rupture of chorioallantoic sac

Pulse rate and respiratory rate (physiological measures)

- In parturition stage we recorded
- . lateral to sternal recumbency
 - . grinding to teeth
 - . vocalization
 - . sweating
 - . complete delivery of the foal

In Post partum, time of shedding of placenta and incidence of placentophagia is recorded.

Mother & Foal Interaction

For mare we recorded : latency of time from birth to the first (smelling, licking, stand, smacking of lips, feeding and shedding of placenta).

For the foal we recorded : latency of time from birth to the first (stand, successful stand, vocalization, passing of meconium and cutting of umbilical cord). Suckling behavior was investigated for 1 hour daily at (7, 24, 48, 72 and 120 hrs) post partum.

Suckling frequency was recorded as number of suckling / hours while suckling bout and pause between two successive bouts was measured by second.

Hormonal Assay

Mare blood samples (10 ml) were taken directly after parturition from jugular vein puncture, then centrifuged at 3000 rpm and the serum were taken for conservation under - 20 c. samples were subjected to lab for hormonal analysis (progesterone and prolactin) by Competitive Eliza using Chromate Awareness Technology Device (USA made).

Statistical Analysis

It was performed by using spss software and the finding results were provided as mean ,maximum and minimum.

Results

Thirty mares were included in this study and some behavioral and hormonal measurements were performed whereas the obtained result of (Table 1) revealed that Arabian mares have gestation length (GL) ranged from 317 to 338 day with a mean of 327.5 day and the primiparous mares recorded 324 d (GL) and multiparous mares recorded 327.5 day.

Concerning the effect of foal sex on (GL), results indicated that mean (GL) of colt recorded 319.5 d and for filly recorded 327.5 d. the difference between both sex was statistically significant

Concerning the age and body weight of the dam, there was effect on(GL) whereas the age from 6-10 years showed 322 d as (GL) and from 11-15 years showed 327.5 d. while the body weight 400 -600 kg showed 325.5 d and 700-800 kg showed 327.5 d (GL). the difference was not statistically significant

Obtained results in Fig.1 revealed that 70% of mares foaled AM (50 % multiparous, 20 % primiparous) at 14.00 to 17.00 hours and 30% PM

(20% multiparous, 10 % primiparous) at 3.00 to 9.00 hours.

Obtained results in (Table 2) revealed that:

First stage of labor (contraction phase) lasted about 24 minutes, this period characterized by some behavioral changes that recorded by frequency such as looking to flank region (12 time /24 minute), Move back and forth (3 time / 24 minute), Kicking to ground (2 time / 24 minute), Feeding(3 time / 24 minute), Set vex down of dam (3 time / 24 minute) then Rupture of chorioallantoic sac.

Second stage of labor were recorded 14 minute , it was characterized by Lateral to sternal recumbency along 11 minutes, Increasing respiratory rate and pulse rate at 4.26 minute, Gasping to air & sweating at 5.40 m, Vocalization with descending of meconium at 6.50 minute, Grinding to teeth at 7.7 minute then descending of fetus at 14 minute.

Third stage (placental or cleaning phase) results indicated that placenta take about 65 minute to be expelled, all mares recorded normal birth with no placentophagia.

Our results indicate that dam first contact with foal was at 1.12 m post parturition, first licking of foal was at 10.50 m pp and mother start to lick foal as soon as before standing up whereas the first stand to mare at 11.60 m, Smacking to lips at 20.15 m, mother return to normal behavior pattern (feeding activity) within 16.44 m PP (Table 3) while the first attempt of foal to stand was 5.15 m after delivery while first Successful standing at 105 m, first suckling at 110 m, first foal vocalization was recorded at 60 m post partum with descending of meconium, umbilical cord was cutted after the mother stand up (at 12 m pp).

Suckling behavior of foals were recorded one hour daily for consecutive 5 days. Obtained results

(table 4) indicate that foal at first day suckled about 6 time per hour whereas suckling bout was 49.5 second , in the second day suckling recorded 8 times /hour with suckling bout 80 s, while in the third day number of suckling recorded 4 times with suckling bout 73 s. in the fourth day the suckling recorded about 3 time / hour with suckling bout 70 s, at the fifth day the suckling was 2 time / hour with suckling bout 70 s, the pause between two suckling bouts for first two days were about 5 m then start to increase day after day.

Hormonal analysis results in (Table 5) indicated that average of prolactin level range from 0.09 to

0.65 with average 0.37 ng /ml , while mean of progesterone level range from 0.2 to 1.2 with the average 0.7 ng / ml.

Discussion

Gestation length (GL)

Gestation length (GL) are of interest as breeder want to have early foals, watch over the foaling and maintain 12 months foaling interval [13]

There are a variation in gestation period in mares but generally it lasts approximately 340 days, However, it can range from 320 days to 370 days .It has been recorded that some mares can carry their foal for over a year[1].This is similar to our results that showed the gestation length ranged from 317 to 338 day with average 327.5 day.

Some studies were applied on gestation length as [2] that recorded The gestation length mean for 25 breeds was 342.3 \pm 10.2 days. with average 2 range between individual animal of 301 to 388 day. While [14] founded that GL ranged from 320 to 360 day with mean 335.5 day [15] mentioned that gestation period in Arabian mares range from 300 to 371 day with average 332day and the same results were obtained by [16]

[15 – 17 – 18] stated that Factors influencing the length of gestation may be broadly classified into 3 categories endocrine, genetic, environmental,the heritability of gestation length is 36 % and male fetuses are carried longer than females.this is disagree with our study that showed that females fetus carried more than males.

The obtained results indicated that the age and body weight of the dam affected on(GL) whereas the age from 6-10 years showed 322 d as (GL) and from 11-15 years showed 327.5 d,. while the body weight 400 -600 kg showed 325.5 d and 700-800 kg showed 327.5 d (GL) but the difference was not statistically significant and this is similar to study of [13] that showed the age and wight had no significant effect on gestation length.

Foaling time

There are many possible environmental cues that animals can use to induce and arrest seasonal fertility including temperature, rainfall and food availability, Ultimate reproductive success is built upon the production of offspring during optimal food availability [12]

Animals have developed a range of strategies to ensure optimal chances for survival, among of them,

processes for ensuring the optimal timing of reproductive function. There is growing recognition that circadian timing system, in particular recently discovered clock gene,plays a major role in a wide range of physiological systems [12]

Normal gestation length can vary widely in the mare. Most mares foal during non business hours for horse breeders and practioners. thus many sleepless nights can be spent waiting the mare to foal [19]

[11] stated that most of foaling occur at night, 86 % between 19.00 and 7.00 hours. [20] believed that the general parturition in angulates tended to occur during the time of least activity that's during resting period of the species.this all agree with our study that indicated 70% of mares foaled AM (50 % multiparous, 20 % primiparous) at 14.00 to 17.00 hours and 30% PM (20% multiparous, 10 % primiparous) at 3.00 to 9.00 hours.

Stages of parturition

During the recent years awareness of the labour process it's impact on welfare, health and even economic return in domestic animals has increased among the public, owners and the scientific community whereas one of the principles of welfare that animal is freedom of pain,accordingly, there must be awareness and attention to parturition process [21]

Parturition is a complex physiological process and involves many hormonal, morphological, physiological and behavioral changes. Labour is a crucial moment for numerous species and is usually the most painful experience in females century to the extensive research in humans, there are limited pain studies associated with process in domestic animals. Parturition is a significant event for numerous species and is frequently the most painful experience that female suffer [22],unlike other acute pain experiences, labor pain is physiological and unique,not associated with disease or trauma, and it's Prescence doesn't indicate any pathology, but the progression of labor itself [23] and the most basic experience of life, the birthing of new individual [24]. However, several factors may hinder the normal process of parturition and modify or increase the degree of pain caused by it. large proportion of women describe parturition as severely painful [25-26] for that reason, labor pain in women has received great scientific interest. [21]

According to [9-23] the parturition classified into 3 stages first, second and third stage,the first stage extend from time of stress till rupture of

chorioallantoic sac and characterized by sweating, restlessness, colic signs, flehmen reaction, frequent tail switching, and milk from the teats, it last from 1 to 4 hours, and Parturition stage extended from rupture of sac to complete delivery of foal, it is characterized by discomfort, sternal to lateral recumbency with extension to four legs, strong contractions of the abdominal muscles with frequent urination and defecation, it last about 20-30 minute, third stage characterized by signs of discomfort then The fetal membranes are expelled, it last about 3 hours. This is disagree with our study that showed the First stage of labor (contraction phase) lasted little time about 24 minutes, Second stage of labor were recorded 14 minute and the Third stage (placental or cleaning phase) take about 65 minute.

Mother - Young Relationship

Parturition represents a transitional moment for the mare-foal relationship then later. The biological bond between the mother and infant experienced during pregnancy are substituted with lactation and other behavioral and physiological interaction [27]. In our study similar behavior was performed by mares after parturition.

Concerning to non-human animals, The term of maternal behavior refers to the behavioral pattern showed at the arrival of a young, in the caring and defense of recently arrived young, and the weaning of those young. It represents a complex, predictable pattern that is frequently regarded as a single species-specific phenomenon [28]

Studies on maternal behavior in the past 50 years observed that parturient and pregnant females perform behavioral patterns related to the newborn arrived almost immediately and the impending arrival of the offspring [29]. This agree with our result whereas all mares showed normal behavior toward the young immediately after birth.

After birth, period of reciprocal stimulation between mother and young is take place due to the precocial nature of the ungulate infant and the mother's active care, the equids, sheep and related genera, as well as most of large bovines are classified as follower type species [20]. This is commensurate with our results that revealed the foals were follower to their mothers all the time.

Foal behavior

Obtained results From (Table 3) mentioned that the first attempt of foal to stand was 5.15 m after delivery while first Successful standing at 105 m,

first suckling at 110 m, first foal vocalization was recorded at 60 m post partum with descending of meconium, umbilical cord was cut after the mother stand up (at 12 m pp), this confirm the result of study [30] that showed the umbilical cord is cut when mother is stand up or foal is struggle after birth the foal stood unassisted within 49.2 min and passage of meconium at 30.8 min while first nursing was recorded at 111.7 min [15]

Suckling Behavior

Some authors [31] mentioned that Nursing occurred about four times per hour during the foal's first week of life and foals spent an average of 1.04 min at suckling bout. The number of suckling per hour and The amount of time foals spent at the udder during any one nursing bout decreased gradually as they grew older, he also found that in week one after parturition the foal has average of five to seven nursing bout per hour and the total mean bout duration was about 100 seconds. our Obtained results indicate that foals at first day suckled about 6 time per hour whereas suckling bout was 49.5 second, in the second day suckling recorded 8 times /hour with suckling bout 80 s, while in the third day number of suckling recorded 4 times with suckling bout 73 s. in the fourth day the suckling recorded about 3 time / hour with suckling bout 70 s, at the fifth day the suckling was 2 time / hour with suckling bout 70 s, the pause between two suckling bouts for first two days were about 5 m then start to increase.

Hormonal Mechanism Of Maternal Behavior

The equine mechanism of parturition is not completely understood, but general concepts have been elucidated and reviewed, Parturition is a complex process that involves changes at the hormonal, physiological, morphological and behavioral levels [21], in our study some hormones (prolactin, progesterone) related to maternal behavior were analyzed after parturition within (8 -12 hr.).

the prolactin is steroid hormone produced by a variety of tissues including the ovaries, uterus, placenta, it is important in normal maternal behavior whereas participate in lactogenesis and development of mammary gland [3], Obtained results in (Table 6) indicated that average of prolactin level range from 0.09 to 0.65 with average 0.37 ng/ml this results agree with study of [3] that showed that prolactin decreased after placental expulsion to reach less than 0.5 ng/ml in normal foaling and reported that progesterone regulates lactogenesis as well as maternal expression. It primes the brain to be

sensitive to the offspring's cues at parturition and regulates the timing of this heightened sensitivity, [32] stated that decline in plasma levels may be related to priming maternal behavior. However, [33] reported that progesterone concentration was not detectable during the period from the first day after parturition until the rise usually associated with ovulation and the formation of the corpus luteum. But evaluations revealed that the progesterone concentration on the first postpartum day was 2.8 ± 0.26 ng/ml. The concentration of progesterone decreased until foal heat. Similar results were obtained in other studies [34-35]

Result of (Table 5) indicated that mean of progesterone level range from 0.2 to 1.2 with the average 0.7 ng / ml. This is agreeing with study of [36] that mentioned the mean progesterone concentrations markedly decreased ($p < 0.05$) during the 48 h after parturition. Serum progesterone values averaged 2.8 ± 0.26 ng/ml on the day of parturition and then decreased to less than 1 ng/ml 4 days postpartum

Conclusion

The maternal behavior in Arabian mares was thoroughly investigated. 30 brood mares from EL Zahra Arab stud were included in this study. The

gestation length and foaling time were recorded and stages of labor, hormonal assay (prolactin, progesterone) were analyzed to indicate the normal maternal behavior whereas the rising of prolactin than normal cause foal rejection while increasing of progesterone cause persistant corpus leteum and the mare not come in foaling heat , in recent years, awareness of the labor process , it's impact on welfare, healthy and even economic return in Arabian horses industry have increased among the public , owners, and scientific community.

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Declaration of Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical of approval

This study follows the ethics guidelines of the Faculty of Veterinary Medicine, cairo University, Egypt.

TABLE 1. The Gestation length (GL) in Arabian mares in relation to sex of foal, parity, age, and body weight of the dam.

	Number	Minimum	Maximum	Mean
Gestation length (GL) (days)	30	317	338	327.5
Sex of foal				
Colt foal	9	317	322	319.5
Filly foal	21	317	338	327.5
Parity of mare				
Primiparous (PP)	9	321	327	324
Multiparous (MP)	21	317	338	327.5
Age of mare				
6-10 Year	12	317	327	322
11-15 Year	18	317	338	327.5
Body weight of mare				
400- 600 kg	21	317	334	325.5
700 -800 kg	9	317	338	327.5

TABLE 2. Stages of parturition of Arabian mares (contraction – delivery and cleaning) with behavioral and /or physiological changes expressed as frequency, time or degree.

Stages	Behavioral traits	Frequency
Í- Contraction phase	Looking to flank region	12
	Move back and forth	3
	Kicking to ground	2
	Feeding	3
	Set down of dam	1
	Rupture of chorioallantoic sac	
Time of first stage		24 minutes
ÍÍ- Delivery phase	Behavioral/ physiological traits	
	Lateral to sternal recumbency	11 m
	Increasing respiratory rate	***
	Increasing of pulse rate	***
	Gasping to air & sweating	***
	Vocalization	30 sec
	Grinding to teeth	50 sec
	Descending to fetus	
Time of second stage		14 minute
ÍÍÍ- Placental phase (cleaning phase)	Behavioral traits	
	Latency to First licking to foal	10.50 m pp
	Latency to First stand to mare	12 m pp
	Smacking to lips	20.15 m pp
	Latency to First feeding	16.44 m pp
	Descending of placenta	65.22 m pp
Time of third stage		65 minute

N.B : *** indicate high rate

TABLE 3. Maternal and Foal behavioral traits expressed as latency of time from birth till the presence of activity.

Mare Behavior Traits	Time (minute)	Foal Behavior Traits	Time (minute)
First contact with foal (smelling)	1.12 m	First attempt to stand	5.15 m
First licking to foal	10.50 m	Successful standing	105 m
First stand of the mother	12.00 m	First suckling	110 m
Smacking to lips	20.15 m	First vocalization	60 m
First feeding	16.44 m	Distance between stand and suckling	5.00 m
Descending of placenta	65.22 m	Cutting of umbilical cord	12.00 m

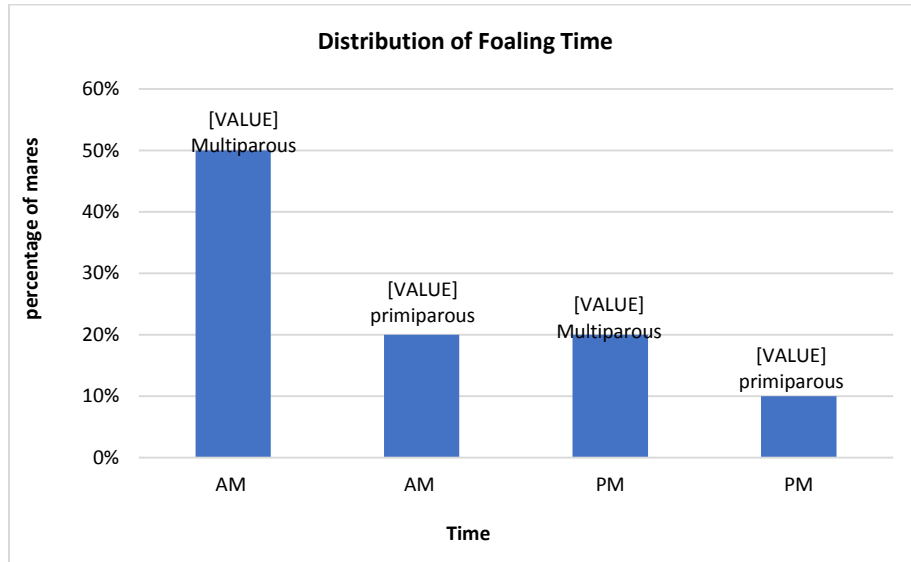
TABLE 4. Ontogeny of Suckling behavior in Arabian foals during the first week after birth expressed as suckling frequency, suckling bouts and pause between two successive suckling.

Postpartum period Hours	Suckling frequency No/hour	Suckling bout Second	Pause bet. two suckling bouts Minutes
7	6	37.5	5
24	6	61	5
48	8	80	*
72	4	73	10
96	3	70	*
120	2	60	*
Total mean	4.83	63.6	6.31

N.B : * indicate Not Recorded

TABLE 5. Hormonal profile (progesterone and prolactin) of Arabian mares (ng/ml) after parturition (8-12 hour)

Hormone	Minimum	Maximum	Average
Progesterone	0.2	1.2	0.7
Prolactin	0.09	0.65	0.37

**Fig. 1 . Circadian rhythm of foaling time in primiparous and multi parous Arabian mares.****A****B****Plate 1. Neonatal foal search for the udder ; it explore between the mother two hind limb**



A



B

Plate 2. Successful Suckling behavior by the foal



A



B

Plate 3. Exploratory behavior of young foals to it's environment



A : Foal stand beside its mother



B : Foal sleep with it's mother

Plate 4. (A,B). Foal follow it's dam in most of her activity

References

1. Long M. M, Pregnancy And Parturition In The Mare thesis, *The University of Arizona* (2018)
2. McCUE P. M. and FERRIS, R. A. Parturition, dystocia and foal survival: A retrospective study of 1047 births, *Equine Veterinary Journal*, **44**, Suppl. 41, 22-25 (2012)
3. Bridges, R. S. Neuroendocrine regulation of maternal behavior. *Frontiers in Neuroendocrinology*, **36**, (178–196) (2015).
<https://doi.org/10.1016/j.yfme.2014.11.007>
4. Müller, A., Stefan, G., Beatriz, V., Anna, W., Thomas, O., Harald, S. and Dominik, B. Increase of skin temperature prior to parturition in mares, *Theriogenology*, **190**,46-51(2022).
5. Myrthe, W., DVM, DACT. Staging and Prediction of Parturition in the Mare, Elsevier (2005)
6. Santos, N. and Beck, A. A review of maternal behaviour in dogs and potential areas for further research. *Journal of Small Animal Practice*, **61**(8), 13085 (2019), DOI - 10.1111/jsap.13085
7. Crowell Davis, S. L. Understanding foal development and its relevance to raising orphaned foals. *Veterinary Technician J.*, **11**(15), 318-328 (2007).
8. Akkose, M., Eren, K., Seref, I., Gürcan, Ç. D., Ceyhan, O., Ufuk, K., Mustafa, Ç. and Bayram, T. Changes in serum total protein and immunoglobulin G concentrations and Brix percentages in neonatal Arabian foals from birth up to 21 days of age. *Veterinary Immunology and Immunopathology*, **255**,110521(2023)
9. Krakowski, L., Piotr, B., Izabela, K., Grzegorz, O., Jan, M. and Tomasz, P. The Level of Prolactin, Serum Amyloid A, and Selected Biochemical Markers in Mares Before and After Parturition and Foal Heat, *Journal of Equine Veterinary Science*, **84**,102-854(2020)
10. Sinha, J. K., Areeba, A., Shampa, G. and Manchala, R. Maternal behavior ; *Encyclopedia of Animal Cognition and Behavior Springer Nature Switzerland* (2019)
11. Rossdale, P. D and Short, R.V, The time of foaling of Thoroughbred mares. *J. Reproduction.Fert.*, **13**,341-343(1967)
12. Boden, M. J. and Kennaway, D.J. Circadian rhythm, *Reproduction Journal*, **132**, 379 -392(2006).
13. Laura, H.,Clous, M., Sanchez, V. and Marcelo, R. Gestation length variation in domesticated horses and its relation to breed and body size diversity. *Zurich Veterinary Journal*, **84**,44-51 (2017).
14. Ali, A., Alamaary, M. and Al- Sobayil, F. Reproductive Performance of Arab Mares in the kingdom of Saudia Arabia. *Tierärztl Prax*, **242**, 145-149(2014).
15. El-Wishy, A., El-Sayed, M., Seida, A., Ghoneim, I. and Serur, B. Some aspects of reproductive performance in Arabian mares in Egypt. *Reprod. Domest. Anim.*, **25**, 227-234 (1990).
16. Meliani, S., Benallou, B., Abdelhadi, S.A., Halbouche, M. and Naceri, A. Environmental factors affecting gestation duration and time of foaling of Pure Bred Arabian mares in Algeria. *Asian J. Anim. Vet. Adv.*, **6**, 599-608(2011).
17. Howell, C. and Rollins, W. Environmental sources of variation in the gestation length of the horse. *J. Anim. Sci.*, **10**, 789-796(1951).
18. Davies, M., Newcombe, J.R. and Holland, S.J. Factors affecting gestation length in the Thoroughbred mare. *Anim. Reprod. Sci.*, **74**, 175-185(2002).
19. William, B. L., Nikola, A. P., Jim, M. B. and Wynne, A. D. How we induce the normal mare to foal, *AAEP Proceedings*, **44**,194-197 (2019)
20. Lent, P.C., Mother-Infant Relationships in Ungulates. The Behavior of Ungulates and Its Relationship to Management. *IUCN Publications*, The papers of an International Symposium held at the University of Calgary, Alberta, Canada 2-5 November 1971. *Morges*, 14-55 (1974).
21. Julio, M., Ramon, M., Hugo, B., Dina, V., Adriana, D. and Daniel, M. Parturition in mammals : Animal models,pain and distress.*Animals J.*, **11**,2960 (2021).
22. Ison, S.H.; Jarvis, S.; Hall, S.A.; Ashworth, C.J. and Rutherford, K.M.D. Periparturient behavior and physiology: Further insight into the farrowing process for primiparous and multiparous sows. *Front. Vet. Sci.*, **5**, 122 (2018).
23. Medrzycka-Dabrowska, W., Czyz-Szyphenbej, L. and Pietrzak K, J. A Review of randomized trials comparisons of epidural with parenteral forms of pain relief during labour and its impact on operative and cesarean delivery rate. *Animals*, **11**, 26 -25 (2021).
24. Lowe, N.K., The nature of labor pain. *Am. J. Obstet. Gynecol.*, **186**, (5 Suppl Nature):S16-24 (2002).
25. Labor, S. and Maguire, S., The Pain of Labour. *Rev. Pain*, **2**,15–19 (2008).
26. Nanji, J.A. and Carvalho, B. Pain management during labor and vaginal birth. *Best Pract. Res. Clin. Obstet. Gynaecol.*, **67**, 100–112(2020).
27. Gabriel, N. P., Sergio, T., Marcio, G. and Monicalevy, A., Maternal behavior in basic science ;transitional research and clinical applicability. *Review Basic Science*, **11**(2), 256-260(2013).
28. Mark, B. Kristal, The biopsychology of maternal behavior in non human mammals, *ILAR Journal*, **50**, 51-63(2009).
29. Gubernick, D.J., Klopfer, P.H., eds.. Parental Care in Mammals. New York: *Plenum Press* (1981).
30. Andreson, K. The Foaling Mare, *Neb Guide* (2008)

31. Crowell – Davis, S. L., Nursing Behavior And Maternal Aggression Among Welsh Ponies (EQUUS CABALLUS), *Applied Animal Behaviour Science*, **14**,11-25(1985).
32. Saltzman, W. and Maestriperri, D., The neuroendocrinology of primate maternal behavior. *Progress in Psychopharmacology and Biological Psychiatry*, **35**, 1192– 1204(2011).
33. Gygax, A.P., Ganjam, V.K. and Kenney, R.M. Clinical, microbiological and histological changes associated with uterine involution in the mare. *J. Reprod. Fert. (Suppl.)*, **27**, 571–578(1979).
34. Lovell, J.D., Stabenfeldt, G.H., Hughes, J.P. and Evans, J.W., Endocrine patterns of the mare at term. *J. Reprod. Fert. (Suppl.)*, **23**, 449–456(1975).
35. Hillman, R.B. and Ganjam, V.K., Hormonal changes in the mare and foal associated with oxytocin induction of parturition. *J. Reprod. Fert. (Suppl.)*, **27**, 541–546 (1979).
36. Gunduz, M. C., Guven, K. and Bulent, E. Follicular and steroid hormone changes in Arabian mares in the postpartum period, *Animal Reproduction Science*, **109**,200–205(2008).

دراسة تحليلية لسلوك الأمومة في الأفراس العربية

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الملخص

تم تحليل سلوكيات الامومه في الخيول العربية بشكل كامل ودراسه العوامل المؤثره علي طول الحمل كما تم تسجيل فتره الحمل وتوقيت الولاده لكل فرس حيث اوضحت النتائج ان فتره الحمل للفرسات كانت تتراوح ما بين 317 الي 338 يوم بمتوسط 327 ونصف يوم واختلفت النتائج بين الفرسات البكر ومتعدده الولادات فكانت فتره الحمل للبكر 324 يوم بينما الاخرى 327 ونصف يوم كما اوضحت النتائج ان 70 % من المهاري تمت ولادتهم ما بين 14.00 صباحا الي 17.00 صباحا 50 % منهم متعدد الولادات و20% منهم بكاري بينما 30 % من المهاري تمت ولادتهم في الساعه ما بين 15.00 مساء الي 21.00 مساء 10% منهم بكاري و20% منهم متعدد الولادات.

كذلك تم تحليل عمليه الولاده بمراحلها الثلاثه المرحله الاولى (مرحلة الانقباض) استغرقت حوالي 24 دقيقة، تميزت هذه الفتره ببعض التغيرات السلوكية مثل النظر إلى المنطقه الجانبيه (12 مرة / 24 دقيقة)، التحرك ذهابا وإيابا (3 مرات / 24 دقيقة)، الركل على الأرض (مرتين / 24 دقيقة)، الاكل (3 مرات / 24 دقيقة)، الجلوس علي الارض (3 مرات / 24 دقيقة) ثم تمزق الكيس المائي.

سجلت المرحله الثانيه من المخاض 14 دقيقة، وتميزت بالاستلقاء الجانبي لمدة 11 دقيقة، وزيادة معدل التنفس ومعدل النبض عند 4.26 دقيقة، وزيادة التعرق عند 5.40 دقيقة، والجزع علي الأسنان عند 7.7 دقيقة ثم نزول الجنين عند 14 دقيقة.

كما أشارت نتائج المرحله الثالثه (مرحلة المشيمه أو مرحلة التنظيف) إلى أن خروج المشيمه استغرق حوالي 65 دقيقة من بدايه الولاده ، وسجلت جميع الأفراس ولادة طبيعية مع عدم اكل المشيمه في اي من الأفراس .

كذلك سجلت سلوكيات الامهات والمهاري بعد الولاده فكان اول اتصال للام مع المهر عند 1.12 دقيقه بعد الولاده، وكان أول لعق للمهر عند 10.50 دقيقه، وبدأت الأم في لعق المهر بمجرد الوقوف حيث كان أول وقوف للفرس عند 11.60 دقيقه، وكانت عودة الام إلى ممارسه انماط سلوكها الطبيعي (نشاط التغذيه) في حدود 16.44 دقيقه بعد الولاده بينما كانت أول محاوله للمهر للوقوف عند 5.15 دقيقه بعد الولاده بينما تم الوقوف الأول بنجاح عند 105 دقيقه، وتمت الرضاعة الأولى عند 110 دقيقه، وتم تسجيل أول صوت للمهر عند 60 دقيقه بعد الولاده ، ثم قطع الحبل السري بعد وقوف الأم (عند 12 دقيقه).

تم تسجيل سلوك الرضاعة للامهات ساعه يوميا لمدة 5 أيام متتاليه. وأشارت النتائج التي تم الحصول عليها إلى أن معدل رضاعة المهر في اليوم الأول حوالي 6 مرات في الساعه بينما بلغت طول مدة الرضاعة 49.5 ثانيه، وفي اليوم الثاني سجلت معدلات الرضاعة 8 مرات / ساعه لمدته 80 ثانيه، بينما في اليوم الثالث سجلت عدد الرضعات 4 مرات لمدته 73 ثانيه في اليوم الرابع سجلت الرضاعة حوالي 3 مرات/ساعه مع فتره رضاعة 70 ثانيه، في اليوم الخامس انخفضت معدلات الرضاعة الي 2 مرة/ساعه مع فتره رضاعة 70 ثانيه، وكانت فترة التوقف بين نوبتي الرضاعة في اليومين الأولين حوالي 5 دقائق ثم بدأت في الزيادة يوما بعد يوم. كما تم تحليل بعض الهرمونات المتعلقة بسلوك الام الطبيعي كالبروجسترون والبرولاكتين لاثبات سلوك الامومه الطبيعي عند الافراس .

الكلمات الدالة: الافراس - سلوك الحمل - الرضاعة.