Acta vet. scand. 1991, *32*, 319–325.

Onset of Luteal Activity in Non-Foaling Mares during the Early Breeding Season in Finland

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Koskinen, E. and T. Katila: Onset of luteal activity in non-foaling mares during the early breeding season in Finland. Acta vet. scand. 1991, 32, 319–325. – The luteal activity in mares was studied in the Equine Research Station (ERS) and in trotting stables (TS) in South-Finland. The mares were Standardbreeds in the TS and mainly Finnhorses in the ERS. Between January and June blood was collected once a week for serum progesterone determinations. The mares in the ERS were distributed in 1 of 3 groups: three-years old not yet in training (N = 38), brood mares (N = 21) and mares in training (N = 47). A 4th group was the mares in training in the trotting stables (N = 73).

Every 5th mare in the ERS and every 4th mare in the trotting stables were cycling already at the beginning of the year. Onset of luteal activity in anoestrous mares was most common in the middle of May. Over 95 % of the mares were cycling at the beginning of June.

In the ERS 40 % of the Finnhorse mares in training were cycling through the winter. The three-years old and the brood mares were all anoestrous during winter. They started to cycle on average before the middle of May. Anoestrous training mares started before the middle of April.

Anoestrous Finnhorse mares began to cycle later than warm blooded mares in all of the groups studied. Mares which had foaled the previous year were more often anoestrous during the winter than dry mares.

The time of year when cycling began in a particular mare tended to be the same from year to year ($p < 0.01$).

anoestrus; progesterone determination; ovulation; horses.

Introduction

Horses breed naturally during the time of year that offers optimum food supplies and environmental conditions for survival and development of the foal (*Ginther* 1979). However, because of the official birthday of 1st January and claim for better performance of early foals in sales and first racings, breeding very early in the year has also tended to increase in Finland. Moving away from the physiological breeding season causes problems in breeding practices.

Ginther (1979) has summarized some seasonality reports based on rectal palpation and slaughterhouse specimens, concluding that most but not all horse mares are anoestrous during the winter months. However, the proportion of ovulatory oestrous periods in studies based on rectal palpation is probably lower than in studies based on progesterone determinations. In 1 study 20 % of progesterone rises were not associated with a diagnosis of ovulation on rectal palpation (*Palmer & Jousset* 1975).

Several factors are known to contribute to the occurrence of winter anoestrus. The effect of breed is well-known, pony mares being more often acyclic in winter than horse mares (*Palmer* 1978, *Wesson & Ginther* 1981). An effect of a foal at foot during the previous summer has also been claimed. *Palmer & Driancourt* (1983) reported winter anoestrus in 3 out of 10 maiden or barren mares as compared to 13 out of 13 mares which had had a foal the previous summer. According to *King et al.* (1988) declining average progesterone concentrations during luteal phases from May to September are the first signs of impending anoestrus. Seasonal patterns can repeat themselves, a mare in winter anoestrus often also being anoestrous next winter (*Palmer* 1978).

The onset of cyclical activity is also influenced by a number of factors. Light is the most important of these (*Ginther* 1979). The role of other environmental factors such as exercise or extreme temperatures in horses is not clear. More is known about nutrition and breeding efficiency. Mares which gained weight started cycling earlier than mares which lost weight (*Ginther* 1974). *Ginther* (1979) summarized the role of nutrition by stating that day length is the stimulus for initiation of the ovulatory and anovulatory seasons but food supply has a modifying role. A certain level of nourishment is needed for the activation of ovaries by light. The effects of age and breed are obvious. Very young (< 5 years) pony mares stopped cycling earlier and old (> 15 years) mares started cycling later than mares in other age groups (*Wesson & Ginther* 1981). The ovulatory season is shorter in pony mares than in horse mares (*Ginther* 1979, *Wesson & Ginther* 1981).

It has been suggested that the greater the distance from the Equator, the longer will be the period of anoestrus in mares (*Neely* 1983). It might be presumed that mares were more frequently and more profoundly in anoestrus in northern latitudes because the days during winter are shorter than in countries closer to the Equator. *Ginther* (1979) has summarized slaughterhouse survey reports from various southern and northern latitudes (from 25° S to 56° N) but they did not lead to any conclusions on latitude influence. *Ginther* (1979) summarized that the peak incidence of foaling for Standardbred mares seems to occur 1 month earlier at latitudes of < 40° than at latitudes of > 40°. However, horses have not been studied in the far north, where the winter days are very short. The purpose of this study was therefore

- to examine the frequency of winter anoestrus and the onset of subsequent luteal activity in the northern latitudes of Finland, where the winter days are short,
- bearing in mind breed differences, to determine the frequency and length of the anovulatory season in Finnhorse mares,
- to examine if there is a difference between Finnhorses and warm blooded,
- to examine if age and management would have an effect on the anoestrous pattern.

Materials and methods

The data were collected from the Equine Research Station (ERS) and from 6 trotting stables (TS) in the southern Finland, at a latitude of 61° N between 1985 and 1989. In the ERS the records relating to the mares were divided into 3 categories, depending on their use and stable conditions on farm,

1. three-years old (N = 38) not yet in training and stabled in a barn with no heating,
2. mares in training (N = 47, mean age 4.9 years, SD ± 1.3 years),
3. Brood mares (N = 21, mean age 9.5 years, SD ± 5.7 years) kept in separate warm stables in individual boxes.

The study was carried out over several years but only the 1st record for each mare was included in each category. The data included 2 breed categories, Finnhorses and warm blooded horses. Warm blooded mean here warm blooded trotters (Standardbreds) and half bred riding horses. In the ERS the mares were Finnhorses and warm bloods. Finnhorses are used mainly for trotting. Training is usually started in autumn, at ages 2 and 3 years in Standardbreds and Finnhorses, respectively. Brood mares and training mares were housed in separate 9 m^2 stalls. The mares were released into a paddock for 4 h every day. The three years old were kept in a barn with free access to a paddock. No effort was made to try to influence the beginning of cycling in mares (e.g. by hormone therapy or light therapy). The lights were on in stables during the day between 6:00–6:30 a.m. and 6:00–6:30 p.m. However, because extra care of horses in training was sometimes needed, lights were sometimes on in training stables for longer e.g. up to 10:00 p.m. Although there were several kinds of bulbs in the stables, the light intensity was estimated to correspond to one 60 W light bulb per stall.

In the trotting stables, the mares (N = 73, mean age 5.1 years, SD ± 1.6 years) were American Standardbreds. They were studied in 1987. They were used only for training and racing. Mares were housed in separate boxes in stables. They were out for training or in a paddock every day for a few hours. The lights were on in their stables from about 6:00 or 7:00 a.m. to about 5:00 or 6:00 p.m.

The onset of cycling was estimated by taking weekly blood samples for progesterone determination, beginning in January. Progesterone was determined in the serum samples by a direct RIA (radio immuno assay) method[1]. Cycling was considered to have begun when there had been 2 subsequent elevated (< 10 nmol/l) progesterone concentrations.

[1] Farmos Diagnostica, Turku, Finland.

The times of onset of cycling from year to year in a particular mare were analysed in 15 Finnhorse mares for which there were records from 2–4 successive years. The mares were used only for training.

Statistical analyses of the data were performed by means of analysis of frequency (frequency of anoestrus in mares with foal at foot vs maiden mares) and analysis of variance[2]. The dependent variable was the number of weeks from the beginning of the year and the independent variables were the type of use of mares (Model 1), age (Model 2) and mare itself (Model 3).

Results

Every 5th mare in the ERS and every 4th mare in the trotting stables were cycling already at the beginning of the year. Onset of luteal activity in anoestrous mares took place most frequently in the middle of May. Over 95 % of mares were cycling at the beginning of June.

Of the Finnhorse mares, 40 % (19/47) in training in the ERS were cycling at the beginning of year. The 3 years old and brood mares were all anoestrous in January (Table 1). In the trotting stables, 26 % (19/73) were cycling already in January. In the ERS the frequency of winter anoestrous was slightly higher in Finnhorse mares in training (60 %; 28/47) than in warm blooded mares (44 %; 4/9).

Among the groups examined in the ERS, Finnhorse mares started to cycle later than warm blood mares (Table 2). Finnhorse mares in training and Standardbreds in trotting stables began to cycle during the first fortnight of April. Three year old Finnhorse mares started to cycle 3 weeks later (p <

[2] CATMOD and GLM procedure in SAS, SAS Institute Inc., SAS Circle, Box 8000, Cary, NC 27512-8000, U.S.A.

Table 1. Cumulative percentages of onset of luteal activity after winter anoestrus in different types of Finnhorse mares in the Equine Research Station.

Month	Weeks from January 1st	Three-year-olds N=35	Training mares < 3 yrs N=47	Brood mares N=21
Jan	0	0	40	0
–	–	–	–	–
Feb	8	0	43	0
Feb	9	3	45	0
March	10	3	45	0
March	11	6	47	0
March	12	11	53	0
March	13	11	57	0
April	14	14	64	5
April	15	17	77	10
April	16	23	79	10
April	17	26	83	14
May	18	34	83	14
May	19	54	85	24
May	20	71	89	52
May	21	91	98	62
May	22	97	100	91
June	23	97	100	95
June	24	100	100	100

0.01) and Finnhorse brood mares 5 weeks later ($p < 0.01$) than mares in training (Table 2, Model 1).

The effect of previous lactation was studied in 5-year old Finnhorse mares. There was a statistically significant difference in the frequency of winter anoestrus between mares with foal at foot, 12/12, and maiden mares, 12/19 ($p < 0.01$).

Five-year old, 6–14 year old and > 14 year old Finnhorse mares which had been lactating the previous autumn started to cycle 17.6 (N = 12), 20.4 (N = 5) and 22.0 (N = 4) weeks after 1st January ($0.05 < p < 0.10$, Model 2).

There was a statistically significant difference between the mares in relation to time of onset of cycling ($p < 0.01$, Model 3).

Table 2. Onset of luteal activity in anoestrous mares in Finland in the Equine Research Station (ERS) and in trotting stables (TS).

	N	Weeks from January 1st Mean	SD	Min	Max
Brood mares	26	19.7	2.8	13	24
– Finnhorses	21	20.2	2.5	14	24
– warm bloods	5	17.2	2.9	13	20
Three-year-olds	38	18.0	3.6	9	24
– Finnhorses	35	18.4	3.4	9	24
– warm bloods	3	13.0	2.6	11	16
Training mares (ERS)	32	15.1	3.9	8	22
– Finnhorses	28	15.6	3.8	8	22
– warm bloods	4	11.5	2.1	9	14
Training mares (TS)* (Standardbreds)	38	14.1	4.6	7	20

* 16 anoestrous mares were dropped out during the follow-up from the original material of 73 mares, since the animals were taken to another trainer. Thus the mean onset of cycling would in fact be somewhat later than the figure shows, if all mares had been included.

Discussion

The progesterone pattern provides a reliable means of classifying ovarian activities (*Palmer & Jousset* 1975). Earlier reports on the seasonal distribution of ovulation have been based mainly on examination of slaughterhouse specimens (*Nyborg* 1953, *Arthur* 1958, *Osborne* 1966, *David* 1975, *Wesson & Ginther* 1981).

The study reported here supports the general view that horse mares are seasonal breeders, with an ability to cycle year round (*Ginther* 1979).

It is possible that the different lighting conditions to which the mares were exposed affected the incidence of winter anoestrus and the onset of cycling. In a training stable in the ERS lights could have been on from 6:00

a.m. to 7:00–10:00 p.m. (i.e. for 13–16 h). This differs from the circumstances in stables for brood mares and three year old, in which lights were on from 6:00–6:30 a.m. to 6:00–6:30 p.m. (i.e. for about 12 h). *Scraba & Ginther* (1985) found that stimulatory lighting from midsummer to winter resulted in 5/17 pony mares cycling throughout the year. All control mares were anoestrous during winter. Lights in the training stable late in the evenings might have stimuleted some of the 23/56 Finnhorse and warm blooded mares which cycled throughout the year. It has been found that light treatment of 14.5 to 16 h a day is effective in hastening the onset of cycling after winter anoestrus (*Palmer et al.* 1982) and that it is effective even if the light is not switched on every day (*Scraba & Ginther* 1985).

In addition to the marked effect of light, other environmental factors such as nutrition may play a role (*Ginther* 1974). Horses in all of the groups in the ERS were in general regarded to be in "too good" a condition rather than in poor condition. Horses in training received larger amounts of concentrates than horses in other groups. However, the amounts and types of feed were very much the same in the mares in training in both the ERS and the trotting stables.

The difference in frequencies of anoestrus between lactating (12/12) and dry (12/19) mares supports the results of *Palmer & Driancourt* (1983) on the effect of lactation on impending anoestrus. However, in our study lactating and dry mares were not kept under the same stable (lighting) conditions.

Our finding that Finnhorse mares, which were lactating previous autumn, started to cycle later as they became older is in agreement with the results of *Wesson & Ginther* (1981). However, the difference was not statistically significant in our study, probably because of the small number of animals.

Yearly seasonal patterns seem to be similar. *Palmer* (1978) found that the same mares exhibited winteranoestrus from year to year. Our results show that a mare tends to begin cycling about the same time during subsequent years.

The common belief in Finland, that warm blooded begin to cycle earlier than Finnhorses, was partly supported by this study. Finnhorses started to cycle about 1 month later than warm-blooded. However, because of the small number of warm-blooded the difference was not statistically significant.

The smaller number of cycling mares in training during winter in the trotting stables as compared to the ERS (26 % vs. 40 %) was probably more a consequence of the smaller use of lights in the TS than an influence of breed. Other contributory factors might have been differences in nutrition and training. It is the author's opinion that the mares in the TS were more intensively exercised than mares in the ERS and possibly also not as fat. It is well known that amenorrhea is common in female athletes in hard training. Contributory factors are a low body fat percentage, physical and mental stress, and production of endorphins which suppress GnRH (gonadotrophin releasing hormone) release (*Speroff* 1984). Similar factors could affect ovarian function also in mares.

It was apparent from a previous Finnish study (*Saastamoinen & Ojala* 1988) that foalings take place in Finland considerably later, especially in Finnhorses, than in other countries for which monthly foaling percentages have been published (*Ginther* 1979). However, it was not known if this reflected differences in breeding policies, use of light and hormone therapies etc. or resulted from a later ovulatory season. The results from the present study indicate that the late foaling is a result of late onset of cycling. Our mares at a latitude of 61° N started to cycle about a month later than mares at a latitude of 40° N (*Kenney et al.* 1975) or in southern latitudes (*Ginther* 1979).

It would seem that all mares in Finland generally ovulate at the beginning of June. In fact, most conceptions take place at the beginning of June in Finland (*Saastamoinen & Ojala* 1988). Earlier in spring, confirmation of cycling by weekly progesterone determinations saves time.

Acknowledgements

We thank Dr. Pirkko Valmari for helping in collection of blood samples and trainers at the trotting stables for their good co-operation.

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Sammanfattning

Igångsättning av lutealfasen hos icke-fölande ston under den tidiga avelssäsongen i Finland.

Lutealfunktionen hos ston undersöktes vid Hästforskningsstationen (HF) samt vid någon travcentral i södra Finland (TC). Stona vid TC utgjordes av varmblodiga travhästar och vid HF av finnhästar. Progesteron i serum bestämdes en gång i veckan under tiden januari–juni. Stona vid HF indelades i 3 grupper: treåriga ston som ännu inte börjat tränas (N = 38), fölston (N = 21) och ston i träning (N = 47). Den 4. gruppen utgjordes av ston i träning vid TC (N = 73).

Brunstcykeln var igång hos vart femte sto i HF-gruppen och hos vart fjärde sto i TC-gruppen re-

dan i början av året. Lutealfasen hos de anöstrala stona började oftast i mitten av maj. Brunstcykeln var igång hos mer än 95 % av stona i början av juni.

Fyrtio procent av de finnhäststona i träning hade brunstcykel under hela vintern, medan stona i de 2 andra grupperna vid HF var anöstrala hela vintern. Deras brunstcykel började i medeltal före mitten av maj, medan första brunstcykeln hos de anöstrala stona i träning inleddes före mitten av april.

Av de olika grupper var de anöstrala finnhäststona sist med igångsättningen av sin brunstcykel. Vinteranöstrus förekom oftare hos ston som hade fölat under föregående år än hos sådana som inte fölat.

Tidpunkten på årstiden då brunstcykeln började tenderade att vara den samma hos de individuella stona under flera år ($p < 0.01$).

(Received January 19, 1990; accepted August 16, 1990).

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