BRIEF COMMUNICATION: Factors influencing gestation length and interval from foaling to conception in mares managed on a commercial Thoroughbred studfarm

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Keywords: horse; breeding; gestation length; Thoroughbred; mare.

INTRODUCTION

The gestation length of mares is typically accepted as 335 to 342 days, but may range from 300 to 400 days. Most studies examining factors that may affect gestation length have been conducted in the Northern Hemisphere where foaling management may be markedly different from routine management in Australasia, where foaling takes place outdoors at pasture, and mares are kept at pasture year-round.

The Thoroughbred breeding season in New Zealand starts on September 1 and typically ends in mid-December. There is strong economic pressure to have mares foal as early in the season as possible, as older foals tend to have size and maturity advantages over later born foals when presented at the yearling sales.

It has been suggested that reproductive efficiency can be maintained if a mare becomes pregnant within 25 days from the start of the breeding season or post-foaling (Loy, 1980). However, with a highly variable gestation length and the imposed restricted breeding season, a yearly foaling pattern is difficult to maintain. Nearly 63% of mares in one American study missed at least one breeding season during their reproductive career (Bosh *et al*., 2009).

The aim of this study was to obtain preliminary data on gestation length and variables influencing gestation length, and the interval from foaling to conception, on a commercial New Zealand Thoroughbred breeding farm.

MATERIALS AND METHODS

Reproductive data were available for 15 breeding seasons between 1993 and 2007, on a commercial Thoroughbred breeding farm located in the lower North Island of New Zealand (Latitude 40°21′). Each mare was classified as maiden, lactating or empty at the start of each gestation period. Gestation length was defined as the time from last mating to parturition. The time of conception was defined as the last date of mating prior to a positive pregnancy transrectal ultrasound examination. The foaling to conception interval was calculated as the number of days between foaling and conception.

Gestation length and foaling to conception interval data were examined for normality, descriptive statistics and one way analysis of variance were calculated using SPSS v17 (SPSS Inc, Chicago, Illinois, USA) with the significance level set at $P < 0.05$. Means are presented ± standard deviation.

RESULTS

Foaling records from 333 mares were included, resulting in 627 viable foals, hence 627 gestation lengths could be calculated. Foaling and breeding records from within the same season were available from 242 mares, resulting in 406 pregnancies with a range 1 to 6 pregnancies per mare. This allowed 406 records for examination of the interval from foaling interval.

The mean duration of gestation was 352 ± 10 days with a range of 309 to 398 days. There was no significant difference in gestation length between years. Gestation length was significantly longer for colt foals than for filly foals (353 ± 0.6 and 351 ± 0.5 days, respectively, $P < 0.001$). The month of mating had a significant effect on subsequent gestation length, with mares bred later in the season having shorter gestation lengths (September 357 ± 11, October 354 ± 11, November 350 ± 9 and December 346 ± 8 days gestation, respectively, $P < 0.001$ for all comparisons). There was a significant individual mare effect on gestation length ($P < 0.001$). Five sires stood at the stud between 1993 and 2007, with no significant effect of foal sire on gestation length. The reproductive status of the mare at conception influenced gestation length, with empty mares having significantly longer gestation lengths than maiden or lactating mares (356 ± 12 vs. 352 ± 12 and 349 ± 9 days, respectively, $P < 0.001$). Mares that resided at the stud for the duration of their pregnancy had longer gestation lengths than mares who resided on other properties during their pregnancy (353 ± 10 vs. 350 ± 11 days, respectively, $P = 0.001$).

The mean interval from foaling to conception was 32 ± 6 days, ranging from 8 to 117 days for 237 mares and 407 pregnancies. The individual mare significantly influenced the mean interval from foaling to conception (P <0.001) and mares bred in December took longer to conceive compared to mares bred in October or November (37 ± 20 vs. 30 ± 11 and 30 ± 15 days, respectively, P = 0.002).

DISCUSSION

In our study, significant associations were identified between gestation length and month of breeding, foal gender, reproductive status of the mare at conception, and the individual mare herself, in agreement with previous studies (Marteniuk *et al.,* 1998; Davies Morel *et al*., 2002). However, the mean gestation length of 352 days for mares in this study was longer than reported for Northern Hemisphere Thoroughbred mares of 344 days reported by Davies Morel *et al*. (2002) and Standardbred mares of 343 days reported by Marteniuk *et al.* (1998). This may be partly accounted for by the use of last breeding date in the calculation of gestation length as true ovulation dates were not available. However, human chorionic gonadotrophin was routinely given to mares 24 to 36 hours before breeding at this stud and mares were examined for ovulation around 48 hours post-breeding, so "true" gestation lengths could be two days shorter than reported. The differences in gestation length could reflect managerial or climatic differences, as Northern Hemisphere mares are frequently housed and foaled indoors, although this required further investigation. Hodge *et al.,* (1981) demonstrated that increasing photoperiod artificially resulted in a 10 day shorter mean gestation length compared to mares exposed to normal daylight hours. It is possible that artificial lighting used for housing and foaling mares indoors could potentially decrease gestation length. It has been reported that prolonged nutritional deprivation is associated with increased gestation lengths (Howell & Rollins, 1951). However, the influence of nutrition could not be evaluated in the present study. Often pasture availability is reduced in winter and early spring compared to later spring and early summer. Nutrition may also have contributed to the different gestation lengths of mares that stayed at stud during their pregnancy compared with mares grazed elsewhere during pregnancy.

Mares bred earlier in the season had longer gestation lengths than those bred late in the season, as noted in Northern Hemisphere studies (Marteniuk *et al.,* 1998; Davies Morel *et al*., 2002). Day length and environmental temperature may influence gestation length (Davies Morel *et al*., 2002), with shorter day length and cooler temperatures being associated with longer gestation lengths. The variation in gestation length with month of conception may be a mechanism to ensure the foal is born at a time when food resources are most likely to be plentiful.

Colt foals had gestation lengths of 2 days longer than filly foals, in agreement with other studies (Marteniuk *et al.,* 1998; Davies Morel *et al*., 2002). The reason for longer gestation of colt foals is unclear; it has been suggested that the different endocrine functions of male and female fetuses may interact differently with the endocrine control of parturition (Jainudeen & Hafez, 2000).

Mares that were empty at the time of conception had longer gestation lengths than lactating or maiden mares. This may be largely confounded by the month of breeding, as breeders try to get empty mares in foal as early in the season as possible. However, the difference in gestation length between empty and maiden mares, which are also bred as early as possible in the season, cannot be explained. Empty mares tend to be older mares, which tend to have more variable gestation lengths (Platt, 1988). Fetuses of older mares, or mares with significant degenerative endometrial changes, may suffer from intrauterine growth retardation, which may result in prolonged gestation (Platt, 1988).

The mean foaling to conception interval was 32 days in this study, indicating that many mares had a drift in foaling date. Eventually the mare will not be rebred when she is considered to be "too late" and will be re-bred in the following season. This loss in productivity can influence profitability (Bosh *et al.,* 2009). The longer mean gestation length observed in this study meant mares effectively had even less time to get back in foal in that season on the study stud. Further research is required to determine if long gestation lengths are typical on other New Zealand studs, and the influence this has on the number of years in which a mare is not productive and a foal is not produced. Mares bred in December had longer foaling to conception intervals than mares bred earlier. Late foaling mares may have had difficulty conceiving in the previous season following breeding on multiple cycles, due to underlying reproductive problems, which would also be present in the next breeding season.

In summary, mean gestation length of Thoroughbred mares at this single New Zealand stud were longer than commonly reported gestation lengths of Thoroughbred mares. Further research to investigate associations between gestation length and the level of nutrition New Zealand horses is warranted. In order to obtain foals at yearly intervals it is important to breed maiden and empty mares in early spring, and to bred foaling mares as early as possible: either at foal heat or "short cycle" after foal heat to minimise the foaling to conception interval.

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