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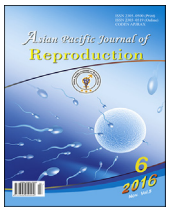

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Factors affecting length of gestation in artificially inseminated Marwari mares of India

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ABSTRACT

Objective: To study the factors affecting length of gestation in foals from artificially inseminated Marwari mares for a period of ten consecutive breeding seasons.

Methods: Gestation length was measured in 126 pregnancies from which viable foals have born. Time of ovulation was confirmed through ovarian ultrasonography in order to determine true gestation length (ovulation to till foaling) as different to previous studies, in which either the mating to foaling interval or from fertilization to till parturition was used for calculating the gestational length. All the mares were inseminated artificially with frozen thawed stallion semen at appropriate time points by monitoring the point near to ovulation. Pregnancy was diagnosed approximately 11–15 d after ovulation initially, and re-affirmed at 30–60 d of pregnancy.

Results: The observed mean gestation length for all the foals was recorded to be 342.20 ± 1.91 (with standard deviation 21.4) d, and ranged from 259 to 388 d. Various factors like parity of the mare, fetal gender, fetal birth weight, season of breeding (Artificial Insemination) and season of foaling were considered for their effect in causing variation on the gestation length in Marwari mares. According to the present study point of view and after compilation of the results, season of breeding and foal birth weight were found to show significant effect in causing true variation of the gestation length in Marwari horses. Other factors like sex of the foal and parity of the mare also had an effect on length of gestation, but whose effect was observed to be non-significant. Over the range of gestation lengths observed, season of foaling was not significantly associated either with gestational length of mare or foal birth weight.

Conclusion: From the current study it can be concluded that the true average gestation length for Marwari foals born is 344.1 ± 0.49 d. The range of gestation lengths was found to be 315–388 d all resulting in viable foals. The length of gestation is not significantly affected by age and parity of the mare. The only factors significantly affecting gestation length are foal gender and month of foaling ($P < 0.05$).

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1. Introduction

Marwari breed of horses are well known for their unique characteristics like majestic look, alertness and resistance to unfavorable conditions. These horses belong to Marwar and Mewar area of Rajasthan, India. The Marwari breed is thought to be resulted as a crossing between indigenous Indian ponies and Arabian horses, having some Mongolian influence. They are famous for their ears that point inward and often touch or overlap and are considered to be the most valued animal genetic resource in the region because of speed, vigor and smartness. This Marwari breed can be distinguished from other indigenous breeds in terms of both physical characteristics (Averages between 152 and 163 cm height) and environmental adaptability. As a consequence of indiscriminate breeding practices and rapid mechanisation, the number of this breed has dwindled and as per livestock census (2011), only a few thousand purebred Marwari exist in India. For preserving the genetic heritage of these Marwari breed populations, it is essential to characterize their reproductive traits and functions.

The knowledge of the length of gestation particularly in mares would make possible for determination and calculation of the date of foaling, which would help in better planning and organization of work in stud farms more efficiently, taking care of a due mare and a foal properly, and facilitates planning for the subsequent breeding season, which is especially important in equine breeding farms that do not use artificial insemination [1] and also in routine equine industry. However, in assuming the near accurate time of foaling makes it extreme difficult in assisting the foaling and it consequently can be harmful and may be problematic for both dam and foal. The inability to predict the accuracy of the time of foaling may incur in extra expenditure on labor and cost of veterinary assistance and also high risk for both dam and foal [2]. Therefore, any factor which may be helpful in predicting the accurate time of foaling would be beneficial to the equine farms and farmers [3].

Pregnancy in equines is known to be long and variable; the time gap between foaling and following pregnancy must be the minimum to shorten the next foaling, in order to achieve optimal yearly interval between foals which will be the aim for every equine owner and stud farm. The mean gestation period in horses varies more when compared to other farm domestic animals like cows, sheep, goat or pigs [4], which is may be due to the fact that their length of gestation period is long and is influenced by both physical and physiological factors that have no influence on the length of gestation of other livestock species like, embryonic dispause in other livestock [5,6]. Several studies have confirmed wide variations in length of gestation to extent in several breed of horses [7,2]. It is assumed that the average gestation length period in mares ranges from 330 to 340 d [4], even though many researchers reported still broader range of the length for normal gestation. Gestational length in the mare has been reported by many authors and researchers previously as 339 [8–10], 334 [11], 344 [1], and 305–382 d [12,13] in Thoroughbred mares. The length of gestation was reported to be ranging from 314 to 363 d [14] in Arabian Horses, 311–358 d in Spanish Purebred Andalusian and 313–357 d for Arabian mares [15]. The length of gestation in Przewalski mares was reported as 326 d [16]. Gestational lengths from 310 to 380 d were reported for viable foals born [17–19] in exotic breeds. Much of the work done on estimation of gestation length in mares is contradictory and conflicting, as it is lacking statistical significance in some cases. A list for duration of gestation lengths of mares for various different breeds as reported by many researchers was reviewed, compiled and presented in the Table 1.

In practice, gestation lengths of mares from 320 to 360 d of duration may be considered to in normal range as acceptable [20,21]. There are many variables of maternal (age, breed, parity, service period, health status) [4], environmental (climate and location, month of breeding, month of foaling, photoperiod) [22,23], parity [21,24], fetal (sex, weight, status of pregnancy, horse/mule fetus) [25,21] and other miscellaneous factors (nutritional status, effect opf male used for breeding, year of breeding, managemental practices like artificial lighting) [26–28] that influence the gestation length [1] in mares (Figure 1). The variability in gestation length is much wider, and this large and wider window of the timing in which live foals can be born indicates that length of gestation in mares is susceptible to both the internal and external factors. Till now, all the studies which have reported about the gestation length in mares of different breeds were about the natural matings, whereas, this would be the first and foremost study which will be reporting about the factors affecting the gestational length in Marwari mares inseminated artificially with frozen thawed semen. Till now all the studies done for estimating gestational length were calculated the time from mating to foaling instead ovulation to parturition [2]. This observation was supposed as equal as the time between ovulation to foaling. However, it is well known and established fact that spermatozoa may survive up to 7 days in the mare's reproductive tract and are still capable of fertilizing the oocyte [29]. With the advent of ultrasonic imaging it is possible to calculate accurate time of ovulation and hence, the precise calculation of length of gestation. The time period from ovulation to foaling might, therefore is better considered the same as fertilization to foaling. To conclude in total, the calculation of gestational length, from fertilization to foaling, has been found to be highly reliable [1] to that of mating to parturition. Taking this fact in to consideration we monitored the ovulation time closely with the help of an ultrasound machine. The objective of the present this study is to determine the mean gestation length in Marwari mares and to study the influence of various selected factors like sex of the foal, season of foaling, parity of a mare, fetal birth weight and breeding conditions on the length of gestation.

2. Materials and methods

2.1. Animals

The animals that were considered for the current study included both the primiparous and multiparous mares aged between 4 and 18 years old. All the animals were managed under uniform managemental and housing conditions. All the animals were fed uniformly and no source of artificial light and no special diet were provided. Mares' were provided with water and feed *ad libitum* at all the time. Farm veterinary and reproductive data records were also used to analyzing and determine date of artificial insemination, time of ovulation, foal birth weight, and foaling dates for each viable foal pregnancy.

2.2. Geographical location of the farm

The present study was carried out in a governmental equine farm which is located in western part of India in the city named Bikaner which falls in the state of Rajasthan. The city, Bikaner is