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Factors affecting gestation length and estrus cycle characteristics in Spanish donkey breeds reared in southern Spain

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Abstract

This paper investigated gestation length and estrus cycle characteristics in three different Spanish donkey breeds (Andalusian, Zamorano-Leones, and Catalonian) kept on farm conditions in southern Spain, using data for ten consecutive breeding seasons. Gestation length was measured in 58 pregnancies. Ovarian ultrasonography was used to detect the ovulation, in order to ascertain true gestation length (ovulation-parturition). Pregnancy was diagnosed approximately 14–18 d after ovulation and confirmed on approximately day 60. Average gestation length was 362 ±15.3 (SD) d, and no significant differences were observed between the three different breeds. Breeding season had a significant effect ($P < 0.01$), with longer gestation lengths when jennies were covered during the early period. Breed, age of jenny, year of birth, foal gender, month of breeding, and type of gestation had no significant effect on gestation length.

After parturition, foal-heat was detected in 53.8% of the postpartum cycles studied ($n = 78$), and ovulation occurred on day 13.2 ± 2.7. The duration of foal-heat was 4.7 ±1.7 d, with a pregnancy rate of 40.5%.

When subsequent estrus cycles were analyzed, the interovulatory interval ($n = 68$) and estrus duration ($n = 258$) were extended to a mean 23.8 ± 3.5 and 5.7 ± 2.2 d, respectively. Both variables were influenced by the year of study ($P < 0.03$ and $P < 0.001$), whereas month and season of ovulation ($P < 0.005$ and $P < 0.009$, respectively) affected only interovulatory intervals. Estrus duration was significantly longer than that observed at the foal-heat ($P < 0.006$), and the pregnancy rate was 65.8%.

This study provides reference values for true gestation length and estrus cycle characteristics in Spanish jennies. Breeding season affected gestation length in farm conditions. Also, seasonal influence was observed on the length of the estrus cycle (i.e., interovulatory interval), although foal-heat was not affected by environmental factors.

Keywords: Donkey; Estrus cycle; Foaling; Gestation length

1. Introduction

Spanish donkey breeds (e.g., Andalusian, Zamorano-Leones, or Catalonian) are currently included in the FAO list [1] of domestic animals breeds to be conserved, mainly as a consequence of industrialization. Action must therefore be taken to protect and maintain these breeds and preserve their genetic diversity. Any measures taken should be combined with greater and more detailed knowledge of donkey reproductive activity [2].

Jennies are polyestrual, showing a controversial seasonal pattern [3,4], possibly related to climate differences. Gestation has been reported to last approximately 372–374 d [5]. Careful management of the puerperal pe-

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riod is crucial in jennies, as it is in mares, since they come into foal-heat as early as days 5–13 postpartum, concurrent with the first ovulation [6,7]. While ultrasonography is routinely used for normal management in mares, its use to evaluate postpartum reproductive events [7] and the estrus cycle [8] in jennies remains limited. The average length of the estrus cycle is usually 23–30 d [5,6,9] and thus longer than that reported in mares. The estrus phase lasts 6–9 d, with ovulation 5 or 6 d after estrus onset [2,3,9,10]. Seasonal influences on reproductive function have been reported in jennies, although they appear less marked than in mares or ponies [3]. Although some authors have studied reproductive aspects such as behavior [9,11], estrus cycle [8,12], hormonal patterns [3,10,13], or follicular dynamics [7,14] in jennies, data remain relatively sparse, particularly with regard to Spanish breeds.

The aim of this study was to determine true gestation length based on the exact ovulation time as determined by ultrasonography, and to describe the characteristics of the estrus cycle, both in foal-heat and in cyclic estrus, in Spanish jennies reared in farm conditions in southern Spain. The effect of breed, age of jenny, year of birth, breeding season, foal gender, month of breeding, or type of gestation on gestation length were analyzed. Also, the effects of breed, age of jenny, year of study, month of ovulation, and type of ovulation on foal-heat ovulation, interval between ovulations, and duration of estrus behavior were studied.

2. Materials and methods

2.1. Animal data and management

Clinical reproductive data for three Spanish donkey breeds (Andalusian, Zamorano-Leones, and Catalonian) were recorded over ten consecutive breeding seasons (1995–2004). The study was carried out in jennies aged 3–17 yr, at the Las Turquillas stud in Southern Spain (Ecija, Seville) (37°32′ N, 5° 5′ W). This area has a Mediterranean climate, with severe summers and temperate winters. Rainfall varies from 600–800 mm (23.5–31.5 in) per year, and is concentrated in the period from October to April.

Jennies were kept overnight in individual boxes before and after foaling, and in paddocks during the day, allowing free interaction. Management conditions and nutritional status were similar for all study animals. Jennies were allowed to suckle their offspring *ad libitum*. No additional light exposure was used during postpartum or during the estrus cycle to stimulate ovarian activity. Attending to the reproductive management and behaviour for donkeys in the Southern Spain, the breeding season was taken as September to July, and was divided into three phases: early phase (September to January), mid-phase (February to May) and late phase (June to July). The early phase corresponds to months in which animals are around a transitional period; the mid-phase is considered the official breeding season and animals used to show cyclic, normal ovarian activity; late phase corresponds to months in which jennies are reared under warmer climate, that could affect negatively the reproductive activity. In August, the undesirable effects of heat on the reproductive activity and on the newborn foal provokes that jennies are not mated. Jennies were individually teased every day by the jack, and the first and last day of detectable estrus signs were noted. Mating was by natural service.

Gestation length, considered as the period between ovulation detected by ultrasonography and spontaneous parturition, was calculated using a total of 58 gestation records for Andalusian (n = 28), Catalonian (n = 21) and Zamorano-Leones (n = 9) jennies. Parturitions occurred spontaneously at term.

In order to characterize the estrus cycle, the following were calculated: day of first ovulation postpartum, percentage of detectable foal-heat, duration of estrus signs on foal-heat, pregnancy rate on foal-heat, interovulatory interval, duration of estrus signs on cyclic heat, pregnancy rate on cyclic heat, and percentage of polyovulatory cycles. Foal-heat was considered as the time when jennies began to show estrus behavior within 14 d postpartum and ovulation was detected before or on day 20 postpartum [15]. If estrus signs were not detected within 20 d postpartum, it was considered as postpartum acyclicity. Cyclic heat was considered as estrus appearing after foal-heat. The interovulatory interval was the number of days between two successive ovulations detected by ultrasonography. Sixty-eight interovulatory intervals equal to or shorter than 30 d were recorded; when the interval was longer, data were not considered for analysis. The duration of estrus behavior was calculated for 258 recorded estrus cycles, of which 42 corresponded to foal-heat and 216 to cyclic-heat.

2.2. Ultrasonographic assessment

Ultrasound monitoring was started when estrus signs were detected and repeated daily using a linear-array scanner (Aloka SSD-500, Japan) equipped with a 5.0 MHz, B-mode, transrectal transducer. The jack serviced jennies when accepted. Jennies were mated when ultrasonographic preeminent features [16] for ovulation were observed in the preovulatory follicle (i.e., follic-