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**Research Article**

# Is Pregnancy Length in Martina Franca Jennies Influenced by Lunar Cycle?

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## Abstract

In humans and animals there is a popular belief that spontaneous parturition, and therefore pregnancy length, could be influenced by the lunar cycle, but results from humans are often impaired by multiple variables of the studied population. In domestic animals those problems can be limited by studying restricted population, such as a single breed, reared under uniform conditions.

The present study aimed to assess the possible influence of the lunar cycle on pregnancy length in Martina Franca jennies belonging to a single breeding farm.

The retrospective study was performed on data collected from 96 Martina Franca healthy jennies with a normal singleton pregnancy course. The present study showed that, whit lunar cycle divided in 4 lunar phases, neither lunar phase at ovulation, nor lunar phase at foaling significantly influenced pregnancy length (371.8±6.45 days). Pregnancy length was not significantly influenced also by the month of the year in which ovulation and spontaneous foaling occurred, as well as by jennies' age and foal's sex.

In conclusion, pregnancy length in Martina Franca jennies is very variable (335-395 days) but does not

seem to be influenced by lunar phases at ovulation or at foaling, month of ovulation and foaling, and by jennies' age and foal's sex. Further studies are needed to clarify the reasons for this pregnancy length variability in Martina Franca donkey breed.

**Keywords:** Donkey; Lunar cycle; Ovulation; Pregnancy length

## 1. Introduction

In humans and animals many different physiological aspects were reported to be influenced by the moon phase [1]. In human's, it is often perceived that the onset of delivery can be influenced by environmental factors. Some climatic parameters, such as the atmospheric pressure, the time of the day, and day within the week, are reported to influence the admission to the hospital for labor and/or delivery [2-4]. Beside the above-mentioned climatic factors, also the lunar phases are supposed to influence the time of delivery, even if the scientific studies results remain controversial [4-14]. The main concern regards multiple variables of the studied population according to genetics, social, nutritional, and environmental conditions, impairing results evaluation. The possible effect played by the lunar cycle on parturition timing has been supposed also for animals. In domestic animals, the process of domestication reduced the genetic diversity [15] and within a specific breed the genetic variability is also much lower, due to inbreeding.

Moreover, within a single farm, the climatic conditions, management, nutrition, and environmental conditions are uniform for all the animals. In equine husbandry there is the popular belief that delivery time could be influenced by the lunar cycle. A recent study on cows [15], showed a significant influence of the moon on spontaneous parturition.

The influence of the moon on living beings can be attributed to factors such as gravity and light changes and their supposed actions on hormonal production and regulation [16]. Due to the moving of the moon relatively to the earth and the sun, lunar days are not perfectly 24 hour-lasting and this, in turn, alters the light cycle [17]. Moreover, it was suggested that some cyclic variations related to the lunar cycle can be mediated by melatonin and endogenous steroids, with a release of neurohormones triggered by some factors, such as the electromagnetic radiation and/or the gravitational force of the moon [1].

Some authors [18] investigated the role of the moon at birth on behaviour and cognition in donkeys and found that a 10% linear correlated effect on learning ability played by the moon phase. One study assessed the possible effect played by the moon at mating on the proportion of male to female horse foals at birth [19] but did not find a relation between moon phase at mating and foal's sex.

In mammals, many parameters can influence the pregnancy length and, in turn, the occurrence of parturition. Among them, maternal, fetal, environmental and genetic factors are listed. A previous study [20] investigated some factors affecting pregnancy length in jennies and found that pregnancy duration was influenced by foal's sex, but not by foal birth weight, year of parturition, month of ovulation and parturition, and by the jennies' age.

To the authors knowledge, no studies have focussed on the possible effect of lunar cycle on pregnancy length in donkeys. Therefore, the present study aimed to assess, beside some maternal, fetal, environmental factors, the possible effect of lunar phases at ovulation and at foaling on pregnancy length in Martina Franca donkeys.

## 2. Materials and Methods

The project was approved by the Committee on Animal Research and Ethics of the Universities of Chieti-Pescara and Teramo (http://www.unich.it/unichieti/appmanager/federati/CEISA), Protocol #45/2013/CEISA/COM, approval date July 16, 2013.

### 2.1 Animals

The retrospective study was performed on reproductive records obtained from 96 Martina Franca jennies, during a three-year period, in a single breeding farm located in Taranto (40°25′5″N, 17°14′27″E), in the south of Italy. According to Köppen and Geiger, the climatic classification in Taranto is cold semi-arid climate (BSk); mean temperature is 17.0°C, and the mean annual raining value is 470 mm.

All the jennies, 5-15 years old, 330-360 kg body weight, were kept in open paddocks and daily fed with 6-8 kg of good quality hay, plus 1.5 kg of commercial food for pregnant or lactating mares. They were healthy, dewormed before breeding, and regularly vaccinated.

### 2.2 Estrus monitoring, mating, and pregnancy diagnosis

At the time of estrus onset, all the jennies were monitored by ultrasound every 24 h until ovulation, detected by the disappearance of the dominant follicle [21]. Natural matings with stallions of proven fertility were repeated every other day starting when the follicle was greater than 30 mm in diameter. The day of ovulation was considered as the 1$^{st}$ day of pregnancy. Pregnancy was checked at 14 days after ovulation and confirmed at 28 days after ovulation.

All the jennies were fully monitored from the time of mating until parturition, to check for health, normal pregnancy course, and for normal fetal well-being and development. When parturition was approaching, detected by udder enlargement, all the jennies were moved to individual foaling boxes and supervised by video cameras.

### 2.3 Foalings

In all cases jennies were allowed to foal spontaneously, without interferences, but surveilled, as previously reported [22]. Criteria previously reported for normal spontaneous foaling and for foal maturity, health, and viability in Martina Franca donkey breed, were adopted [20, 21, 23-25].

### 2.4 Lunar cycle

The lunar cycle was divided in the classical four phases: waxing crescent, waxing gibbous, waning gibbous, waning crescent, each one lasting about 7.4 days. Moon phase at ovulation and at foaling records were obtained from the Astronomical Observatory of Abruzzo.

### 2.5 Statistical analysis

Data about jennies' age at parturition, date of ovulation, date of parturition, foal sex and pregnancy

length were recorded for all the jennies. The lunar phase at ovulation and at parturition were also recorded. The statistical analysis was performed by univariate generalized linear model (GLM) to assess the possible influence of month of ovulation, month of foaling, lunar phase at ovulation and lunar phase at foaling on pregnancy length. Jenny's age effect on pregnancy length was assessed by linear regression, while the possible effect of the foal sex on pregnancy length was assessed by $\chi 2$ test. Differences were considered significant with $p<0.05$.

## 3. Results

### 3.1 Clinical findings

All the jennies foaled spontaneously and unassisted at the physiologic term of pregnancy, at 335-395 days after ovulation. All the deliveries were eutocic and in all cases the fetal and placental expulsion times fulfilled the criteria previously reported for normal parturition in Martina Franca donkey breed. All the foals, 63 males (65.6%) and 33 females (34.4%) were mature, healthy, viable, and with body weight within the range previously reported for this donkey breed. Clinical findings are summarized in table 1.

| **Jennies age (years)** | **Pregnancy length (days)** | **Foal expulsion time (min)** | **Placental expulsion time (min)** | **Apgar score** | **Foal birth weight (kg)** | **Time for standing (min)** | **Time for first suck (min)** |
|---|---|---|---|---|---|---|---|
| 9.4 ± 4.3 | 371.8 ± 6.45 | 17.8 ± 6.81 | 52.6 ± 15.21 | 9.3 ± 0.83 | 32 ± 3.95 | 62.9 ± 15.07 | 99.3 ± 29.55 |

**Table 1:** Clinical findings (mean±SD) about the 96 Martina Franca jennies foalings.

### 3.2 Effect of month of ovulation and of month of foaling on pregnancy length

The month in which ovulation occurred did not significantly influence the pregnancy length. The distribution of foalings along the months of the year, was not uniform, with the highest numbers of deliveries in March-June (66.6%), but without a significant influence on pregnancy length (table 2).

| **Jan** | **Feb** | **March** | **April** | **May** | **June** | **July** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 (4.2) | 9 (9.4) | 11 (11.4) | 25 (26.0) | 16 (16.7) | 12 (12.5) | 4 (4.2) | 2 (2.1) | 7 (7.3) | 2 (2.1) | 2 (2.1) | 2 (2.1) |
| 375.7 ± 4.16 | 378.1 ± 8.31 | 380.4 ± 10.53 | 366.8 ± 24.46 | 368.1 ± 9.73 | 366.6 ± 13.45 | 361.3 ± 11.24 | 380.5 ± 7.78 | 365.7 ± 13.79 | 377.5 ± 13.43 | 369.0 ± 0.0 | 371.5 ± 9.19 |

**Table 2:** Distribution of foalings along the months of the year, expressed as number and (%), and pregnancy length, expressed as days (mean±SD) in the 96 Martina Franca jennies.

| | **Lunar phases** | | | |
|---|---|---|---|---|
| | **Waxing crescent** | **Waxing gibbous** | **Waning gibbous** | **Waning crescent** |
| **Ovulation** | 368.6 ± 18.69 | 371.7 ± 8.57 | 372.1 ± 14.62 | 372 ± 6.50 |
| **Foaling** | 371.5 ± 11.52 | 363.3 ± 29.91 | 370.5 ± 17.49 | 370.2 ± 17.80 |

**Table 3:** Pregnancy length, expressed as days (mean±SD) according to lunar phases at ovulation and at foaling, in the 96 Martina Franca jennies.

### 3.3 Effect of lunar phases on pregnancy length

Pregnancy length was not significantly influenced by lunar phases (p = 0.328), nor at ovulation (p = 0.152) neither at foaling (p = 0.216; table 3).

### 3.4 Effect of jennies' age and foal's sex on pregnancy length

Neither jennies' age (p=0.184), nor foal's sex (370.8±17.34 vs 370.5±11.68 d in males and females, respectively; p=0.286) showed a significant influence on pregnancy length.

## 4. Discussion

The present study results showed that neither at ovulation nor at foaling, the lunar phases significantly influenced pregnancy length in 96 Martina Franca Jennies reared under uniform breeding and management conditions. This result is in contrast with recent findings in cows [15], in which the effect of moon phase was significantly associated with timing of spontaneous calving in Holstein cows, with increased births around full moon in multiparous, but not in nulliparous cows. Previously, [12] reported significant clusters of deliveries in relation to full moon in multiparous women, although they considered this data cautiously. In the present study, the retrospective analysis of data did not allow to assess the possible effect of lunar phases at ovulation and at foaling on primiparous and multiparous jennies, because this information was not available from the data records.

The absence of effects played by the lunar cycle on admission to hospital for parturition was also reported by several studies in humans [4, 13, 14, 26], while [12] reported an increased rate of births during the full moon. Pregnancy length was 335-395 (371.8 ± 6.45) days long after ovulation, in agreement with the range (333-395 d), and average duration previously reported for the same donkey breed [20, 22, 23, 27-31]. Pregnancy length resulted highly variable among the 96 studied Martina Franca jennies, confirming the wide length variability in Martina Franca donkey normal gestations, as previously reported by [20], but lower than the 331-421-day long gestation variability reported for three Spanish donkey breeds [32].

Pregnancy length was not significantly influenced by month of ovulation, month of foaling, age of the jenny and foal's sex. Almost all these findings were superimposable with data previously reported for the Martina Franca breed, except for the influence of the foal's sex. In a previous study [20], on a consistent number of subjects, mean pregnancy length resulted 5 days longer in jennies giving birth to male than female foals, while in horse mares [33] a significant

influence of the foal's sex on gestation length was found. Therefore, the possible effect of foal's sex on pregnancy duration remains controversial and need further investigations.

The lacking effect of the month of ovulation and of parturition on pregnancy length, despite a tendency to have a more concentration of foalings (67%) in spring months from March to June, agrees with data previously reported for the same donkey breed [20], However, in Spanish donkeys, [32], reported longer pregnancy length in jennies covered in early breeding season. The distribution of both ovulation and parturition along the whole calendar year is not surprising. Previous studies have indeed reported the absence of a true breeding seasonality in Martina Franca jennies [34] and jackasses [35, 36]. The concentration of foalings in spring months could merely reflect a managerial preference for having births during the period in which there are the best climatic conditions and temperature for the offspring. On the other hand, it could also be supposed that the lowest number of foalings in seasons different from spring, is the result of a low number of jennies with fertile cycles in the summer-to-winter months, as previously reported by Henry et al. [37] for donkeys.

According to the possible effect of month of ovulation on pregnancy length, it is to note that a significant influence of the month of breeding on gestation length was previously reported in the horse mare [33]. The age of jennies did not show influence on pregnancy length, in agreement with previous data from Martina Franca jennies [20], and Spanish donkeys [32], but in contrast with data from the horse mare [33].

## 5. Conclusions

In conclusion, results from the present study showed that, in Martina Franca jennies, reared in a single breeding farm in the south of Italy, the lunar phases at ovulation and at foaling did not influence pregnancy length. In addition, some other factors, such as the month of ovulation and of foaling, the jennies' age, and the foal's sex, did not influence pregnancy length, resulted, however very variable. Further studies are needed to clarify the reasons for this pregnancy length variability in Martina Franca donkey breed.

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## Conflict of Interest

None.

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