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Asian Pacific Journal of Reproduction

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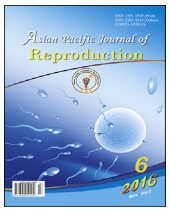

Original research http://dx.doi.org/10.1016/j.apjr.2016.10.001

Prolificity of Portuguese Serrana Goats between 1987 and 2015

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ARTICLE INFO

Article history:
Received 20 Oct 2016
Accepted 24 Oct 2016
Available online 3 Nov 2016

Keywords:
Mountain agro-pastoralism
Local goat breeds
Reproductive efficiency

ABSTRACT

Objective: To evaluate the prolificity of Serrana goats and their four ecotypes (Transmontano, Jarmelista, Ribatejano and Serra) as well its monthly distribution according to parity.

Methods: Data (n = 316610 parturitions) were recorded from 1987 to 2015 and obtained from the pedigree book of Serrana goats for all four ecotypes. The period (month and year) of parturition, females' parity and normal or abnormal parturitions, including abortions, were considered as independent variables. The dependent variable prolificity was calculated by the following formula: number of born kids/parturition.

Results: It was observed an average prolificity of 1.47; from parity order 1 to parity order 5 prolificity increased from 1.33 to 1.57 ($P < 0.001$). The Ribatejano (n = 45925), Jarmelista (n = 31723), Transmontano (n = 238106) and Serra (n = 856) ecotypes showed prolificity averages of 1.60, 1.54, 1.44, and 1.35 ($P < 0.001$), respectively. Globally, and regarding the monthly kidding distribution for multiparous and nulliparous females of Transmontano, Jarmelista and Ribatejano ecotypes, it was also observed for parturitions from December and forward a decrease on prolificity with the minimum value being achieved in April ($P < 0.001$).

Conclusion: These results suggest that females bred in July/August and October could be negatively affected by factors such as feed availability, environmental constraints and management conditions, with impacts on reproductive performance, namely on prolificity, which should be more investigated. Our study allows us to state that the Ribatejano and Jarmelista ecotypes presented higher prolificity than Transmontano ecotype probably due, in part, to genetic differences.

1. Introduction

Goat production is an attractive and profitable activity even when practiced is marginal and poor agricultural areas [1,2] like the majority of goat farms that exist in Mediterranean regions, including the inner areas of Portugal.

Among the reproductive parameters, prolificity is one of the most important in determining the efficiency of the system [3,4] as it is directly related to the economic viability of the flock [5,6]. The number of young born alive per kidding is an important factor in increasing productivity as it contributes more to the total weight weaned per does than the growth rate of kids [6].

The prolificity of meat or milk-meat dual purpose goat breeds, as is the case of the Portuguese Serrana breed, play an important role in the economy of animal production systems. This prolificity is primarily dependent on the genotype, and there

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Peer review under responsibility of Hainan Medical College.
Foundation project: This work was supported by the Foundation for Science and Technology (FCT), project reference UID/CVT/00772/2013.

are even sheep breeds (with Booroola gene) and goats, such as Jining Grey Chinese breed, considered extremely prolific [7].

The prolificity contributes significantly to the annual genetic gain in flocks in which selection is performed, since a lower prolificity rate implies a lower number of born kids per year, which difficult the replacement of livestock, reduces the selection pressure and increases the interval between generations. In fact, prolificity has high heritability compared with other reproductive parameters, leading to a quick response to selection [8]. Other factors may also contribute to the number of kids born by female, among which could be highlight the nutritional and feeding level, body condition, parity and females' age [3,9] or even sexual stimulation/follicular heat and stress.

Increasing meat production is a challenge and a goal for most of the producers. This can be achieved by many ways but the analysis of the genetic potential of a specific breed and how it can be used to improve meat production is a tool that must be available to the producers is order to improve their incomes.

This study aimed to determine the prolificity of the different ecotypes of Portuguese Serrana goats and evaluate its monthly distribution from 1987 to 2015.

2. Materials and methods

2.1. Animal records

The pedigree book (https://genpro.ruralbit.com) of Serrana goat's ecotypes Transmontano, Ribatejano, Jarmelista and Serra, between 1987 and 2015, were used in the present study. Except for Ribatejano ecotype, all remaining ecotypes were located in mountain regions.

The period (month and year) of parturition, females' parity and normal or abnormal parturitions, including abortions, were considered. These records were obtained by technicians responsible for the pedigree book (ANCRAS – Associação Nacional de Caprinicultores da Raça Serrana) which visited farms periodically to identify the individual animals, including kids, and abnormal reproductive occurrences reported by farmers such as the number of abortions and stillborns at parturition. Abortions were detected normally during the second half of pregnancy.

2.2. Statistical analysis

Average prolificity was calculated considering the result of the division of parturitions by the number of foetus in each one, *i.e.*, number of born kids/parturition.

Polynomial regressions degree 3 was used for average prolificity estimates according to each independent variable. The normal distribution of the samples was confirmed before each regression analysis. Still, the Van der Waerden test was also independently used in order to compare all groups and the *P* value obtained was always <0.001.

The comparison of average of prolificity between the four ecotypes of Serrana goats were performed using the Van der Waerden test.

The JMP® 10 statistical software [10] was used for all statistical analysis.

3. Results

During the period between 1987 and 2015, it was observed an average prolificity of 1.47 foetuses by kidding (n = 316610) in the Serrana goat breed.

The kidding's of up to 1, 2 and 3 foetuses were represented in quartiles 50%, 90% and 99.5%, respectively. The remaining 0.5% was represented by births with 4–9 foetuses. Prolificity varied (P < 0.001) according to parity (Figure 1), reaching its maximum around the 5th kidding. When were considered only deliveries without occurrence of stillbirths (and/or abortions), *i.e.* normal live births (n = 292951), there was an average prolificity of 1.51 for the quartiles above mentioned.

Were also observed different (P < 0.001) average prolificity between the four studied ecotypes (Table 1), with the ecotype Ribatejano showing the highest value.

The estimation of average prolificity along the years and months is reported in Figures 1 and 2, respectively and estimation average prolificity according to parturition month for Serrana goats ecotypes Transmontano, Ribatejano and Jarmelista between 1987 and 2015 is showed in Figure 3.

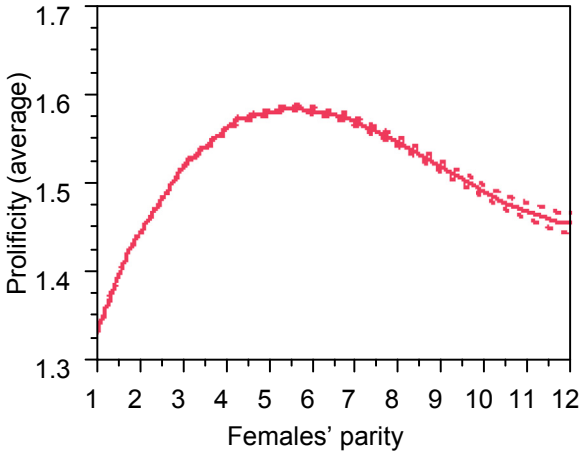

Figure 1. Estimation of average prolificity according to parity for Serrana goats.
R^2 = 0.03; parturitions: n = 316610; P < 0.001. Dashed lines: 95% confidence interval.

Table 1
Average prolificity of Serrana goats ecotypes (P < 0.001).

Ecotypes	Prolificity (average)	95% confidence interval
Ribatejano (n = 45925)	1.60	1.59–1.60
Jarmelista (n = 31723)	1.54	1.54–1.55
Transmontano (n = 238106)	1.44	1.44–1.44
Serra (n = 856)	1.35	1.32–1.39