VIABLE OOCYTE PRODUCTION RATE, EMBRYO TURNAROUND AND PREGNANCY RATE, IN NELORE P.O. AND NELORE CEIP

https://doi.org/10.56238/sevened2025.011-077

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ABSTRACT

Brazilian livestock has established itself as a global reference, driven by advancements in reproductive biotechnologies and the genetic improvement of the cattle herd. The use of techniques such as fixed-time artificial insemination (TAI), fixed-time embryo transfer (TETF), and in vitro embryo production (IVEP) has significantly accelerated genetic progress in meat and milk production. The study compared the reproductive efficiency of the Nelore CEIP and Nelore P.O. lines in three farms located in Minas Gerais. The results indicated that the Nelore P.O. presented higher rates of oocyte conversion into embryos, reaching 47.70% and 67.27%, while the Nelore CEIP obtained 40.05%. In addition, the P.O strain showed a lower rate of discarding non-viable oocytes, evidencing its greater genetic homogeneity and superior quality. These findings highlight the relevance of selecting genetically superior animals, such as the Nelore P.O., in assisted reproduction programs, contributing to greater production efficiency, genetic quality, and sustainability. Thus,

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continuous investment in reproductive biotechnologies and strict genetic selection criteria is essential for the competitiveness and sustainable growth of Brazilian livestock.

Keywords: Reproductive biotechnologies; Breeding; Nelore P.O., Reproductive efficiency; In vitro embryo production (IVEP).

INTRODUCTION

The efficient and sustainable production of beef cattle is one of the biggest challenges of modern livestock, and the improvement of the pregnancy rate is one of the main factors to optimize reproduction in the herd. In the Brazilian cattle raising scenario, Nellore cattle stand out for their characteristics of rusticity and adaptability, becoming the main beef breed in the country (Santiago, 1972). Reproductive biotechnology, through techniques such as embryo manipulation, as well as in vitro oocyte collection and fertilization, has proven to be an effective tool for increasing reproductive productivity (Pinheiro, 2019).

The rate of production of viable oocytes and embryonic turnover are essential parameters that directly impact reproductive efficiency, significantly influencing pregnancy rates in the herd (Pinheiro et al, 2019).

That said, the oocyte production rate is related to the quality of the oocytes collected from females, and their viability is a crucial factor to succeed in assisted reproduction programs. Embryonic turning refers to the process by which fertilized oocytes develop and undergo mitosis, considering that the success rate of this process can vary according to the characteristics of the animals and the reproductive management adopted. Regarding the pregnancy rate, it is associated with the embryo's ability to develop until the gestation stage, thus corresponding to one of the main indicators of reproductive efficiency (Barbosa et al., 2013; Filho et al., 2018).

The Pure Nelore Origin (PO) lineage refers to animals with a fully traceable ethnicity and with assured genetic purity, so they must be registered in the breed's studbook. The PO Nellores have a clear pedigree, so their ancestors are also properly registered and belong to the Nellore breed. This lineage is attributed to genetic improvement programs, with a view to preserving and maintaining its specific characteristics, such as adaptability to the tropical climate and greater resistance to diseases (ANCN, n.d.).

The Nelore CEIP (Special Certificate of Identification and Production) refers to a line of cattle selected based on genetic improvement criteria (Araújo et al., 2023). Thus, this lineage is created based on genomic selection, a technique that uses molecular markers to evaluate their genetic characteristics. According to (Menezes et al., 2019), this method allows the identification of animals with greater productive and reproductive potential, taking into account greater accuracy in the selection of animals, and may culminate in increased productivity and profitability of livestock.

In the context of the Nellore breed, the parameters already mentioned are extremely variable, in view of the existing genetic diversity. Hereditary selection and reproductive

management are primary factors that influence the effectiveness of these methods. Previous analyses validate that, in Nellore herds, the rate of oocyte production is actively linked to the body condition of the females, feeding and sanitary management, as well as embryo turning, which can also be affected by environmental factors, such as humidity and temperature, which directly reflect the success rates in fertilization and embryonic development (Jelonschek et al., 2018).

According to (Pinheiro et al., 2024), in the study entitled "Genetic parameters of in vitro production of embryos of the Nellore and Guzera breeds", important information was evidenced about the production of embryos in vitro and the cleavage rate of oocytes in Nellore donors, which included Nellores of the Pure of Origin (PO) lineage. In the analysis, it was possible to observe that Nellore PO donors have significant genetic variability, a factor that directly influences the efficiency of the production of viable oocytes and consequently the conversion of these to viable embryos. The need for proper management and objective genetic selection is also highlighted, aspects that can improve the success rate in in vitro fertilization techniques. In the embryonic cleavage rates, it was possible to observe, due to the genetic characteristics of the lineage, a superiority in Nellore PO females when compared to other lines, due to their better reproductive performance, thus evidencing the potential of the PO line in improving reproductive efficiency.

Although there are several studies on these reproductive parameters in the Nellore breed, few specifically address the Nellore CEIP (Special Certificate of Identification and Production) lineage. However, the use of Nelore CEIP has expressed potential to optimize the economic efficiency of beef cattle, enabling the identification and selection of animals with desirable characteristics, such as weight gain, fertility, and sexual precocity (Araujo et al., 2023).

MATERIALS AND METHODS

The present study was conducted by collecting data from veterinarians responsible for the farms and laboratories in charge of embryo production. The herds analyzed are intended for the production of breeding bulls, with the objective of serving the market. All farms are located in Minas Gerais, specifically in the northern region of the state. Data were collected from 75 animals, all female, multiparous, healthy, and with a body condition score higher than 2.5. In none of the farms was exogenous hormone therapy used to stimulate the production or synchronization of the follicular wave. At Farm 1, which specializes in breeding Nelore CEIP, data were collected from 38 animals at the end of 2023. At Farm 2, bred by Nelore P.O., data were collected from 16 animals during the period between the end

of 2023 and the beginning of 2024. Finally, at Farm 3, also bred by Nelore P.O., data were collected from 21 animals, in the same periods of late 2023 and early 2024.

For the analysis of the data obtained, two main mathematical methods were used: the sum and calculation of percentages. The sum was used to aggregate the values of each variable collected, providing a global quantitative view of the data. Subsequently, the percentage calculation was applied to contextualize these sums, allowing a comparative analysis between the different elements of the study. The sum facilitated the consolidation of information, while the calculation of percentages enabled a proportional visualization of the results, providing a clearer understanding of the representativeness of each part of the whole. These two methods were essential to ensure an accurate and coherent quantitative analysis, ensuring a clear and objective interpretation of the results.

RESULTS AND DISCUSSION

Table 1 - Viable oocytes and embryonic turning

Farm 1	Nelore Ceip	427 viable oocytes	175 embryonic turning
Farm 2	Nelore P.O	174 viable oocytes	83 embryonic turning
Farm 3	Nelore P.O	165 viable oocytes	111 embryonic turning

At Farm 1, specialized in the breeding of Nelore CEIP, 38 animals were evaluated. A total of 437 viable oocytes were obtained, resulting in an average of 11.81 oocytes per animal (individual variation observed). Of these oocytes, 175 presented morphological characteristics suitable for embryo production, corresponding to a viability rate of 40.05%.

At Farm 2, specialized in the breeding of Nellore P.O., 16 cows were evaluated, resulting in the obtaining of 174 viable oocytes. The average number of oocytes per animal was 10.88, with variation in production among females. Of the total number of oocytes, 83 were considered viable for embryo production, representing a viability rate of 47.70%

At Farm 3, also specializes in the breeding of Nelore P.O., 21 cows were submitted to follicular aspiration, resulting in 165 viable oocytes, with an average of 7.86 oocytes per animal. Similar to Farms 1 and 2, variation in oocyte production was observed among females. Of these oocytes, 111 were considered suitable for embryo production, resulting in a viability rate of 67.27%

Based on the data collected, a trend of higher production of viable oocytes was observed for the production of embryos in animals of pure origin (P.O.). In contrast, in Nellore CEIP, 262 oocytes collected were not considered viable, a relatively high number compared to the breeding properties of Nellore P.O. In Farm 2, a total of 91 oocytes did not show viability, while in Farm 3, this number was 54.

To discuss the reproductive efficiency of the Nellore P.O. and Nellore CEIP lines, it is essential to consider the influence of genetics and selection processes on oocyte viability and embryo formation rate. Studies on genetic improvement indicate that Nelore P.O. has significant advantages in terms of genetic uniformity and desirable characteristics for assisted reproduction (Ferraz & Felício, 2010). This lineage is subjected to a rigorous selection process, in which only individuals that meet specific performance and conformation criteria are registered as "Pure of Origin", resulting in greater genetic homogeneity and productive potential.

The results obtained indicate that the animals of the Nellore P.O. lineage have higher rates of oocyte conversion into embryos when compared to the Nellore CEIP, corroborating the literature on the impact of genetic improvement on reproductive efficiency (Viana *et al*., 2000). In Farm 1 (Nellore CEIP), although the total number of viable oocytes was higher (437), the conversion rate was 40.05%. In contrast, on farms working with Nelore P.O. (Farms 2 and 3), the conversion rates were significantly higher, reaching 47.70% and 67.27%, respectively. The literature shows that genetic variability can negatively impact the reproductive response, being more pronounced in lines with less selection control, as observed in the Nelore CEIP (Torres *et al*., 2009).

Another relevant factor is the rate of disposal of non-viable oocytes. The literature suggests that a high incidence of discarded oocytes may be related to lower genetic quality, which affects the ability of oocytes to develop into viable embryos (Pontes *et al*., 2009). In Farm 1, the number of oocytes discarded was 262, while in Farms 2 and 3, with P.O. lineage, this number was considerably lower, 91 and 54, respectively. This finding is in line with the principles of genetic improvement, which indicate that animals with more rigorously selected genealogy tend to have superior performance in the processes of fertilization and embryonic development (Baruselli *et al*., 2006).

Therefore, the use of Nelore P.O. in assisted reproduction programs proves to be advantageous not only for the greater efficiency in embryo production, but also for the direct impact on genetic progress and the sustainability of herds. As highlighted by Baruselli *et al*. (2006), the selection of genetically superior animals for breeding results in a consistent improvement in herd quality, providing a significant return on investment in reproductive biotechnology.

CONCLUSION

Rigorous genetic selection, applied over a longer period to P.O. animals, favors greater genetic homogeneity and superior oocyte quality, which results in better results in

assisted reproduction programs. In addition, the Nelores P.O demonstrated a lower rate of discarding non-viable oocytes, evidencing a genetic quality that facilitates embryonic development, an essential factor to accelerate genetic progress.

The choice of P.O. animals for genetic improvement and assisted reproduction programs can be considered an efficient strategy, not only for the increase in embryo production, but also for the positive impact on the sustainability and quality of the herd.

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