Keywords: Multiple pregnancies; sheep; scientific publications

ABSTRACT

A twin pregnancy can be observed in many wild or domestic animals, however, for some species, such as sheep, the induction of twin pregnancy is an important tool to improve the efficiency, profitability, and sustainability of the production system. The objective of this study was to carry out a qualitative and quantitative study on the topic of twin pregnancy in sheep, through a scientometric evaluation, in order to ascertain the scientific behavior on this subject in the last 20 years. The scientific production of journals indexed in the Scientific Web of Science and Electronic Library Online databases was analyzed, using the descriptors: double or twin or multiple pregnancy double or twin or multiple births in sheep, in English and Portuguese, which resulted in 62 articles, which were classified according to the year of publication, thematic axis and identification of the main journals. Data were analyzed descriptively. The historical evolution showed a growing increase in the number of publications, especially in the last five years (53.22%), and the main topics discussed were lamb performance, gestation and management, and reproductive performance of the ewe (77.43%). The identification of journals revealed that most publications have quality and scientific rigor. It was concluded that despite the growing behavior, there is a reduced number of publications on the subject in the last 20 years, making it necessary to conduct more research addressing the induction of twin births in sheep as a tool for product sustainability.
INTRODUCTION

Pregnancy is a physiological phenomenon that occurs in mammalian species, characterized by the fertilization of the maternal egg by the paternal sperm, giving rise to a new individual. Pregnancies can be classified as single and twin or multiple. Twin gestation is a complex condition observed in most wild or domestic animal species and occurs when the female gives birth to two or more offspring, usually from the same mating. A twin pregnancy can happen when an embryo splits in two, giving rise to identical twins, or, a more common form, when multiple ovulation occurs due to hormonal imbalances, generating different individuals (FACIOLI et al., 2020).

However, studies have shown that, for some species of domestic animals, especially those of production, both mono and poly ovulatory, the induction of twin or multiple gestations constitutes an important tool in the search for the best production rates and for the sustainability of the system (CAVALIERI et al., 2018). This induction can be based on the use of different reproductive biotechniques or may associate with other techniques, such as genetic improvement and changes in nutritional management.

In the case of small ruminants, such as sheep and goats, it is known that most ewes and goats have only one offspring per pregnancy, as they are mostly mono ovulatory, however, multiple pregnancies can occur and their incidence varies between 20% and 40% in the sheep species and, in the case of the goat species, Medeiros et al. (2006) found 52.3% of twin births in Anglo-Nubian goats. However, recognizing the economic benefits of twin pregnancies in these species, scholars have sought to increase the incidence of these pregnancies, through genetic manipulation, use of reproduction biotechniques, and/or nutritional adaptations of the matrices.

The ovulation rate in sheep varies with race, age, and nutritional condition, being regulated by several genes, thus, in Brazil, scientists who evaluated the Santa Inês sheep breed found the FecGE (FecG-Embrapa – Fecundity Gene) gene GDF9 and found that ewes with this FecGE variant have an 82% higher ovulation rate than others that do not have this change, thus, replicating animals with this variant increases the occurrence of twin or multiple pregnancies, resulting in an increase in the offspring of Santa Inês sheep (CHAVES et al., 2021).
Other studies induced twin pregnancy in ewes through the use of reproduction biotechniques. Seeking to evaluate the effects of different doses of equine chorionic gonadotropin (eCG) in the synchronization protocol of Santa Inês sheep in the Argentine subtropics, Arbués et al. (2018) showed mean values of 15% of double pregnancy in the treated animals. Gottardi et al. (2014) analyzed the use of a hormonal protocol for estrus synchronization and FTAI on the reproductive performance of Morada Nova and Santa Inês ewes and obtained a higher percentage of multiple births of pregnant ewes by FTAI than by natural breeding, submitted to flushing.

Thus, it is inferred that the induction of twin births in sheep can favor the efficiency, profitability, and sustainability of production systems. Even so, more studies are needed to highlight the different directions of investigations; therefore, the objective of this work was to carry out a qualitative and quantitative study on the topic of twin pregnancy in sheep, through a scientometric evaluation of the topic, in order to investigate the scientific behavior on this subject in the last 20 years.

MATERIALS AND METHODS

The object of analysis was the scientific production between the years 2000 to 2020, published in journals indexed on the Web of Science (HTTP://www.webofscience.com) and Scientific Electronic Library Online (SciELO) (https://www.scielo.org), according to the methodological recommendations of Braun and Schubert (1988).

The search for scientific articles was performed using the following descriptors: double or twin or multiple pregnancies and double or twin or multiple births in sheep, in English and Portuguese. The survey resulted in 62 scientific articles.

Afterward, the 62 articles were evaluated to identify the following information: year of publication, thematic axis, and identification of the main journals, in addition to the classification of the journal according to the QUALIS/CAPES/BRAZIL criteria, in the area of Veterinary Medicine.

Data were tabulated and organized in an electronic spreadsheet and descriptive analysis was used.
RESULTS AND DISCUSSION

The results on the historical evolution during the period from 2000 to 2020 showed a growing increase in the number of publications, especially in recent years (Figure 1). This fact highlights the topicality of the topic and the researchers' concern to assess the positive and negative points of twin pregnancy in sheep and its impacts on productivity rates.

![Graph showing the percentage of scientific articles published on “Twin pregnancy in sheep”, according to the three-year period of publication (n: 62).](image)

**Figure No. 1**: Percentage of scientific articles published on “Twin pregnancy in sheep”, according to the three-year period of publication (n: 62).

Regarding the objectives of the research conducted with sheep (Table 1), it was found that the main topics discussed were the performance of lambs (RAMIREZ-TELLO *et al.*, 2013; KORITIAKI *et al.*, 2013; CUÉLLAR *et al.*, 2018; GARCÍA-CHÁVEZ *et al.*, 2020) wool production performance (VAN WYK *et al.*, 2008; SOUZA *et al.*, 2011), on aspects related to pregnancy (ARAÚJO *et al.*, 2014), comparison between biochemical parameters between single and twin gestations (SANTAROSA *et al.*, 2019), pregnancy toxemia, which is a metabolic disorder that can affect ewes with multiple gestations (SANTOS *et al.*, 2011), reproductive management (RODRÍGUEZ-SÁNCHEZ *et al.*, 2020) and reproductive performance of sheep (BANCHERO *et al.*, 2015; CHAI-CANUL *et al.*, 2019; SOUSA *et al.*, 2019), which together accounted for 77.43% of the publications.

In a smaller percentage, articles that addressed carcass yield (CRUZ-COLÍN *et al.*, 2006), genetic progress (TRILLO-ZÁRATE *et al.*, 2019), birth evaluation (FERNANDES *et al.*, 2013),
and studies on the effects of physiological and management factors on the milk composition of Rambouillet ewes (OCHOA-CORDERO et al., 2007).

**Table No. 1:** Number and percentage of scientific articles published on “Twin pregnancy in sheep”, according to the thematic axis of the research (n:62).

<table>
<thead>
<tr>
<th>Thematic axis</th>
<th>Published articles (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamb performance</td>
<td>29,03</td>
</tr>
<tr>
<td>Gestation</td>
<td>24,20</td>
</tr>
<tr>
<td>Management and reproductive performance of sheep</td>
<td>24,20</td>
</tr>
<tr>
<td>Crossbreeding and/or genetics</td>
<td>9,68</td>
</tr>
<tr>
<td>Carcass yield</td>
<td>8,06</td>
</tr>
<tr>
<td>Parturition</td>
<td>3,22</td>
</tr>
<tr>
<td>Milk composition</td>
<td>1,61</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100,00</strong></td>
</tr>
</tbody>
</table>

In the case of small ruminants, such as sheep and goats, it is known that most ewes and goats have only one offspring per pregnancy, as they are mostly mono ovulatory, however, multiple pregnancies can occur and their incidence varies between 20% and 40% in the sheep species, which is an interesting fact for the sheep rearing system, both cut and wool and, therefore, research has been conducted in order to induce this condition.

The ovulation rate, which can vary with the breed, age, and nutritional condition of the sheep, is regulated by the action of several genes. Therefore, in Brazil, scientists from EmbrapaTabuleiros reported that natural genetic alterations in genes that control the ovulation rate and prolificity can be found in sheep of various breeds and, in the case of the Santa Inês breed, the researchers found the FecGE (FecG-Embrapa – Fecundity Gene) of the GDF9 gene and found that sheep with this FecGE variant has an 82% ovulation rate larger than the others that do not have this change. Thus, the researchers aimed to reproduce the animals that had this alteration so that a greater number of ewes in the herd have the capacity to produce more lambs, that is, the use of this technology increases the chance of having twin or multiple pregnancies, increasing the offspring of Santa Inês sheep (CHAVES et al., 2021).
In addition to genetic manipulation, other techniques are also being studied in order to increase the incidence of twin pregnancy in sheep, involving changes in nutritional and reproductive management. Gottardi et al. (2014) analyzed the effect of flushing and the use of a hormonal protocol for estrus synchronization and FTAI on the reproductive performance of Morada Nova and Santa Inês ewes and obtained a higher percentage of multiple births of pregnant ewes by FTAI than by natural breeding. Arbués et al. (2018) evaluated the use of different doses of equine chorionic gonadotropin (eCG) in the synchronization protocol of Santa Inês sheep in the Argentine subtropics and obtained mean values of 15% of double gestation in the treated animals.

Regarding the journals that presented the highest concentration of publications related to the theme "Twin pregnancy in sheep" (Table 2), it is observed that the journal Brazilian Archive of Veterinary Medicine and Animal Sciences totaled 14.52% of publications, followed by Brazilian Veterinary Research, with 9.68% and South African Journal of Animal Science with 8.06%. Journals that published less than 4 articles each, totaled 67.74% of publications.

**Table No. 2:** Number and percentage of published scientific articles on “Twin pregnancy in sheep”, according to scientific journals (n:62).

<table>
<thead>
<tr>
<th>Journal</th>
<th>Published articles (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazilian Archive of Veterinary Medicine and Animal Sciences</td>
<td>14.52</td>
</tr>
<tr>
<td>Brazilian Veterinary Research</td>
<td>9.68</td>
</tr>
<tr>
<td>South African Journal of Animal Science</td>
<td>8.06</td>
</tr>
<tr>
<td>Journals with less than four articles published on the topic</td>
<td>67.74</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Considering the classification of scientific journals according to the Qualis criterion, stipulated by the Coordination for the Improvement of Higher Education Personnel, the foundation of the Ministry of Education and Culture (MEC), Brazil, it was found that the two main journals identified have superior stratum in the areas of Veterinary Medicine, showing the quality, consistency and scientific and methodological rigor of the research.

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CONCLUSIONS

Based on the results obtained, it is concluded that, despite the increasing behavior, there is a small number of publications on the topic of twin pregnancy in sheep in the last 20 years.

The publications, which showed quality, consistency, and scientific and methodological rigor, addressed issues related mainly to the lamb performance, gestation and management, and reproductive performance of sheep.

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Cesumar Institute of Science, Technology, and Innovation - ICETI / Unicesumar, Maringá, Paraná, Brazil.

REFERENCES


