Anatomical Defects Associated with Repeat Breeder Cow Syndrome

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Repeat breeder cow (RBC) syndrome encompasses cows failing three or more times to become pregnant, but with the special characteristic that their estrous cycles have a normal duration. Farmers and technicians commonly feel incapable of addressing this reproductive issue, and after numerous unsuccessful attempts to conceive, it is often necessary to cull cows. Important economic losses are linked to RBC syndrome due to diagnosis, therapy, or reduced milk production, among others.

Keywords: cattle ; estrus ; repeat breeding ; cow

1. Introduction

Nowadays, dairy and beef cattle are being developed under demanding production systems due to increased competitiveness in their markets, amid an uncertain economic world situation characterized by high food and fuel prices, as well as the urgent climate emergency on our planet. In this context, farms need to be highly efficient and profitable, and the identification of non-productive animals is a priority to prevent economic losses. For many years, researchers and technicians have focused on the Repeat Breeder Cow (RBC) syndrome, in which cows exhibit estrus signs at apparently normal intervals (i.e., estrous cycles between 17 and 25 days) but repeatedly fail to be pregnant after at least three attempts, despite the absence of apparent anatomical abnormalities or infectious diseases [1][2][3][4]. While many diagnostic tools for identifying reproductive pathologies are available, it is not practical or feasible to employ all of them, as they can be expensive or technically unavailable. Consequently, cows may experience reproductive imbalances or diseases that are not correctly diagnosed. On some occasions, these subfertile cows may eventually conceive after three or more cycles, but the economic impact of delayed conception often necessitates culling the animals because they become unprofitable and, in the case of dairy cows, produce less milk than the cost of their maintenance.

This problem has been extensively studied in various countries and regions, and researchers widely agree on its significant impact on the farm economy. By reviewing different studies, the frequency of RBC syndrome has been reported as approximately 5% in Jordan [5], 9% in the UK [6], 10% in Sweden [3], 11% in Bangladesh [7], 14% in Japan [8], 22% in the United States [9], 23% in Australia [10] and India [11], 25% in Spain [12], 36% in Cuba [13] and Ethiopia [14], and even as high as 62% in Indonesia [14][15]. The vast variation between countries can be attributed to various management practices, including the aptitude, production system, number of cows per farm, or genetic merit (mainly based on milk yield), among others. Studies have shown higher percentages of RBC syndrome in tie-stall barns [15], where hormonal treatment for reproduction control was not used [14][15], under tropical conditions [11][13][15], or in farms with high culling rate [12], which could be associated with poor animal welfare [16]. This global perspective suggests that the incidence of RBC syndrome could potentially be reduced and controlled.

The majority of studies on RBC syndrome have focused on dairy cows because their reproductive management allows for better monitoring of animals, making it easier to track estrus signs and insemination records. In contrast, beef cattle are typically raised under extensive systems, which makes obtaining such records challenging. However, the implementation of new precision livestock farming technologies, such as GPS collars, accelerometers, or proximity tags, among others, is expected to improve animal data collection and management. These advancements hold the potential to aid in the identification of subfertile cows, including RBCs, which is especially relevant in the case of extensive beef cattle farming due to the difficulty of obtaining reproductive records, as previously mentioned.

The subfertility observed in RBCs can be attributed to various causes, not only of maternal origin but also related to bull defects (as subfertility, anatomical defects of reproductive organs, low frozen–thawed semen quality, difficulties for mounting due to low libido or lameness, high hierarchy of infertile bulls) or management mistakes (wrong site or timing of semen deposition by technician, inadequate heat detection). Multiple factors have been reported as contributing to the

occurrence of RBC syndrome, including subclinical endometritis [17], nutritional deficiencies [18], abnormal heat behavior or improper heat detection [19][20], mismanagement in artificial insemination (AI) [21], or endocrine dysfunctions [20][22]. In relation to hormonal alterations, factors such as elevated progesterone levels, abnormal follicular dynamics, delayed ovulation, and lower oocyte quality have been identified as responsible for subfertility in repeat breeder heifers [23]. Additionally, these causes are influenced by various risk factors that contribute to the occurrence of imbalances and the incidence of RBC syndrome, including factors such as age, parity, body condition, milk yield, environmental conditions, and peri- and postpartum imbalances, among others.

Successful reproductive performance in cows relies on the delicate interplay of hormone patterns, ovarian dynamics, estrus behavior, uterine functions, and mating or AI [23]. Several endogenous factors operating at the ovary, oviduct, or uterus can affect oocyte and embryo quality, thereby influencing the incidence of repeat breeding in dairy cows.

2. Anatomical Defects Associated with Repeat Breeder Cow Syndrome

Oviductal defects, such as tubal stenosis or occlusion, have been associated with the RBC syndrome [24]. These conditions prevent the movement of oocytes and spermatozoa through the oviducts, and if fertilization occurs, the passage of the embryo into the uterus will be difficult. In cows with oviductal alterations, their estrous cycle remains unaffected, showing a normal duration. Sometimes, these issues can be resolved spontaneously. Confirming oviductal patency is challenging, but various methods have been used in studies, including examination at slaughterhouses [25], ultrasonographic contrast liquid [26][27], and dyes (phenol-sulphon-phthalein) [24] or granules (starch) [25]. Tubal inflammation is commonly associated with endometritis, and it reduces sperm motility and impairs sperm–oviduct interaction. The transport of early embryos can also be compromised due to mucus accumulation and reduced ciliary beat frequency in the oviduct. Research has indicated that around 20% of RBCs show bilateral oviduct occlusion or stenosis, while unilateral defects are reported in 24% of cows [24], highlighting the significance of these defects in the etiology of RBC syndrome.

In the search for other causes of RBC syndrome, studies analyze cervical consistency and patency [28]. It is reported that RBCs with normal uterine findings may exhibit cervicitis, which is independent of endometritis [28]. This suggests the importance of conducting a comprehensive breeding soundness examination that includes evaluating the external genitalia, perineal/vulvar conformation, and internal genitalia via vaginoscopy in RBC cases. Cervicitis is characterized by a prolapsed and swollen portio vaginalis cervicis with reddening and can negatively impact conception rates and the number of pregnant cows at 200 days into lactation [28]. Additionally, identifying abnormal vulvar conformation in cows is crucial, as it is associated with pneumovagina, vaginitis, or endometritis (or SCE). According to the definition of RBC syndrome, when reproductive inflammatory alterations are present in cows, they should not be considered RBCs [29]; however, certain inflammatory disorders cannot be correctly diagnosed. In other instances, cows may experience SCE, which negatively affects reproductive performance and can be included in the definition of RBC syndrome.

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