

RESEARCH ARTICLE

Risk factors associated with repeat breeding in female aceh cattle in Pidie District, Indonesia

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Abstract

Background and Aim: Low reproductive efficiency, particularly repeat breeding, is a significant constraint in cattle production systems in Indonesia. Repeat breeding is defined as the failure of a cow to conceive after three or more services with fertile males, without detectable reproductive abnormalities. This study aimed to determine the prevalence of repeat breeding and identify risk factors related to reproductive and management practices in female aceh cattle in Pidie District.

Materials and Methods: A cross-sectional observational study was conducted using simple random sampling. The study population consisted of Aceh cows that had undergone artificial insemination (AI), with data obtained from inseminator records. Primary data were collected through structured interviews with inseminators and farmers, while secondary data were sourced from AI service logs. Statistical analysis was performed using odds ratios (OR) to assess associations, followed by chi-square tests for significance (SPSS 2007).

Results : The prevalence of repeat breeding in aceh cattle was 58.3%. Significant risk factors included poor estrus detection knowledge ($P= 0.043$; $OR= 2.32$), delayed estrus reporting ($P= 0.076$; $OR= 1.90$), inadequate management of pregnant cattle ($P= 0.070$; $OR= 0.37$), and improper placement of feed and water ($P= 0.070$; $OR= 0.18$). Strong associations were also found with poor water source quality ($P= 0.001$; $OR= 3.97$) and prepartum confinement practices ($P= 0.000$; $OR= 0.20$).

Conclusion: In contrast, general husbandry practices, including housing hygiene, floor type, and drainage, showed no significant impact. This study highlights the urgent need for improved farmer awareness and better reproductive management to reduce repeat breeding in aceh cattle.

Keywords: Aceh cattle, artificial insemination, repeat breeding, reproductive management, risk factors

Introduction

Low reproductive efficiency, including reproductive disorders such as repeat breeding, remains a common challenge in cattle production systems in Indonesia. Repeat breeding is defined as the failure of a cow to conceive after three or more

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services with a fertile bull or artificial insemination, in the absence of detectable reproductive abnormalities (Hasib *et al.*, 2020). Cows experiencing this condition typically exhibit prolonged calving intervals (18–24 months), reduced conception rates (<40%), and an elevated number of services per conception (>3) (Yusuf *et al.*, 2010). This reproductive inefficiency leads to significant economic losses for farmers due to decreased calf crops, increased culling rates, and higher veterinary and management costs (Sonjaya *et al.*, 2021).

Multiple factors have been implicated in the occurrence of repeat breeding, one of which is improper timing of insemination. According to Saraswat *et al.*, (2016), insemination conducted too early or too late in the estrous cycle significantly reduces the likelihood of successful conception, contributing to repeat breeding. Furthermore, failure to detect estrus accurately is another major contributor to reproductive inefficiency and reduced pregnancy rates in beef cattle herds (Singh *et al.*, 2019). Farmers' understanding of estrus signs and the estrous cycle is crucial for ensuring timely and effective insemination.

Environmental and nutritional factors also play an important role. Poor hygiene in the housing environment and inadequate nutritional intake are commonly associated with reduced fertility. Unsanitary conditions may predispose cows to uterine infections such as endometritis, a condition frequently linked to repeat breeding (Hasan *et al.*, 2021). Thus, the cleanliness of both the cows and their pens must be prioritized in reproductive management.

In Indonesia, the underlying causes of repeat breeding remain insufficiently understood. However, suboptimal management practices are strongly suspected to be major contributing factors. Traditional cattle farming systems often lack the application of evidence-based reproductive management, including proper estrus detection, accurate timing of insemination, and optimal environmental conditions. These deficiencies may explain the persistently high rates of conception failure and repeat breeding in local herds.

Previous studies have highlighted the urgency of addressing repeat breeding due to its negative impact on reproductive performance and productivity. For example, Singh *et al.*, (2017) emphasized that repeat breeding not only delays reproductive cycles but also leads to increased economic losses for farmers. A Study conducted by Mesele and Hadgu (2024) in Ethiopia found that reproductive inefficiencies, particularly repeat breeding, were significantly influenced by farmer knowledge, animal health management, and feeding practices. Despite global awareness, studies specifically focusing on local breeds such as aceh cattle remain limited, underscoring the need for region-specific research to identify actionable risk factors and guide effective interventions.

Based on the aforementioned evidence, repeat breeding is recognized as a multifactorial problem influenced by both intrinsic animal factors and extrinsic management practices at the farmer level. A thorough understanding of these risk factors is essential, particularly in the context of aceh cattle, which represent a valuable local genetic resource with strategic importance. Therefore, this study was conducted to assess the prevalence and identify key risk factors associated with repeat breeding in female aceh cattle managed by smallholder farmers in Pidie District, Indonesia.

Materials and Methods

Animals and Study Site

The study was conducted in Pidie Regency, Aceh Province, Indonesia. A total of 161 female aceh cattle that had previously undergone artificial insemination (AI) were selected as study subjects. These animals were managed by smallholder farmers and inseminated by five licensed inseminators operating in the area. Data collection involved the use of structured questionnaires, writing materials for field notes, and a digital camera for documentation. Information was gathered through direct interviews with farmers and inseminators, as well as observations in the field, to comprehensively assess the risk factors associated with repeat breeding.

Study Design

This study employed a cross-sectional observational design to identify and analyse potential risk factors associated with repeat breeding in female aceh cattle. The cross-sectional approach was chosen to enable data collection at a single point in time, allowing the assessment of relationships between reproductive outcomes and various management practices implemented by farmers.

Study Population and Respondents

The study population consisted of female aceh cattle with a documented history of artificial insemination (AI), as recorded by five certified inseminators working in the study area. A total of 161 cattle were selected based on these AI service records. The respondents in this study were smallholder farmers responsible for managing the selected cattle. These farmers were interviewed to obtain detailed information regarding reproductive management practices, maintenance practices, and factors potentially associated with repeat breeding.

Sample Size and Sampling Technique

The sample size was determined using the Slovin formula with a 95% confidence level and a 5% margin of error, resulting in 161 cattle. A simple random sampling technique was applied to ensure each eligible cow had an equal chance of being included in the study. This method was selected to reduce sampling bias and improve the representativeness of the findings.

The Slovin formula as follows: $n = \frac{N}{1+N(d)^2}$ description:

n = sample size

N = population size

d = 95% confidence level and desired error of 5% (0.05)

From the results of the sampling calculation, the sample size was obtained

$$n = \frac{272}{1+272(0,05)^2} = 161 \text{ cows.}$$

Data Collection and Study Variables

Data for this study were collected from both primary and secondary sources. Primary data were obtained through structured interviews with smallholder farmers using a pre-tested questionnaire designed to gather information on estrus detection, mating practices, and cattle management. Secondary data were collected from official

AI service records maintained by certified inseminators and the local livestock service office. Data collection tools included printed questionnaires, writing materials, and a digital camera for field documentation.

The study investigated independent, dependent, and control variables. Independent variables were categorized into mating management and maintenance management. Mating management variables included cow age, age at first mating, postpartum estrus detection, reproductive disorders, pregnancy diagnosis, and mating timing. Maintenance management variables encompassed feed type and quantity, water provision, pen hygiene, structural design, pen location, and construction materials. The dependent variable was the occurrence of repeat breeding, defined as failure to conceive after three or more artificial insemination attempts. Female aceh cattle served as the control variable for analysis.

Determination of Repeat Breeding Prevalence

The prevalence of repeat breeding was determined by calculating the proportion of female aceh cattle that failed to conceive after three or more artificial insemination (AI) attempts. This number was divided by the total number of inseminated cows and multiplied by 100 to obtain the prevalence percentage. The resulting prevalence rate served as the primary outcome for evaluating the association between identified risk factors and the occurrence of repeat breeding.

Data Analysis

Data were analyzed to identify associations between potential risk factors and the occurrence of repeat breeding in female aceh cattle. The strength of these associations was assessed by calculating odds ratios (ORs), which provide a measure of the likelihood of repeat breeding in relation to specific risk factors. Statistical significance was determined using the chi-square (χ^2) test, with a significance level set at $p < 0.05$. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 25.

Results and Discussion

Prevalence of Repeat Breeding

The results of this study showed that the prevalence of repeat breeding in female aceh cattle that had undergone artificial insemination (AI) in Pidie Regency reached 58.3% of the 161 cattle examined (Table 1). This means that approximately 58 out of every 100 inseminated female aceh cattle experienced repeat breeding, a condition that can lead to substantial economic losses due to prolonged calving intervals, increased insemination costs, and reduced reproductive efficiency.

Table 1. Prevalence of repeat breeding in aceh cattle following artificial insemination in Pidie Regency

Repeat breeding	N	Prevalensi (%)
Yes	94	58.3
No	67	41.6

N=number of samples

The prevalence observed in this study is slightly lower than reported by Asaduzzaman *et al.*, (2016) for cattle populations in other tropical regions. However, it

remains considerably high and reflects the reproductive challenges faced by smallholder cattle farmers in Pidie Regency.

The regional characteristics of Pidie Regency help explain these findings. Located between 04.30°–04.60° North Latitude and 95.75°–96.20° East Longitude, Pidie Regency covers an area of approximately 3,082.14 km² and consists of coastal lowlands and highland valleys such as Tangse and Geumpang (BPS Kabupaten Pidie, 2023). With annual rainfall of 1,482 mm and average temperatures ranging from 24 °C to 32 °C, the region provides favorable conditions for livestock production. Consequently, Pidie is recognized as one of the main centers for cattle and buffalo farming in Aceh Province, with a ruminant population exceeding 60,000 heads (Dinas Pertanian dan Peternakan Pidie, 2023).

Despite this potential, livestock management in the region remains largely traditional. Extensive grazing systems, where cattle roam freely during the day with minimal reproductive monitoring, are still the dominant practice. Although semi-intensive management is slowly being adopted, many farmers still rely on simple housing with soil floors and poor sanitation. Previous studies have shown that such conditions increase the risk of reproductive tract contamination, particularly when cows lie on dirty surfaces, allowing bacteria to enter the reproductive tract during or after insemination (Mansur *et al.*, 2024). This aligns with the high prevalence of repeat breeding observed in the present study.

Moreover, access to veterinary reproductive health services in Pidie Regency is limited, with only four operational Animal Health Centers (Puskesmas) serving the entire district. Limited technical assistance and delayed pregnancy diagnosis reduce the effectiveness of AI programs and contribute to repeat breeding (Jemal & Lemma, 2015). The low awareness among farmers regarding estrus detection and optimal insemination timing, as well as the large number of cows managed by a single inseminator, further compromises reproductive outcomes.

These findings are consistent with reports from other tropical regions where extensive management, poor housing hygiene, and limited veterinary access have been shown to significantly increase the risk of reproductive disorders, including repeat breeding (Maulana *et al.*, 2022). The high prevalence of repeat breeding in Aceh cattle in Pidie Regency is strongly associated with traditional livestock management practices, suboptimal housing conditions, inadequate reproductive monitoring, and limited access to veterinary services. Addressing these issues through improved management systems, farmer education, enhanced reproductive health services, and better infrastructure is essential to improve reproductive efficiency and reduce economic losses among smallholder cattle farmers in the region.

Farmer Knowledge of Estrus Detection

Interviews with farmers revealed that 77.6% possessed adequate knowledge of estrus signs, while 22.3% lacked this knowledge (Table 2). Early and accurate estrus detection is essential for improving reproductive success, particularly in AI programs. Farmers who understand estrus signs can more accurately determine the optimal insemination time, which is critical for achieving successful conception (Budisatria *et al.*, 2019; Hilmianti *et al.*, 2024).

However, 66.4% of farmers reported estrus to inseminators more than six hours after observing the signs, and only 33.6% reported it within six hours. Although mobile

phone communication has improved, delayed reporting remains a concern that can reduce AI success rates and increase the risk of repeat breeding (Cardoso *et al.*, 2021).

Table 2. Farmer knowledge of estrus and odd ratios (OR) in aceh cattle by farmers in Pidie Regency

Parameter	N (%)	OR
Knowledge of estrus signs		2.32 (p<0.05)
- Know	125 (7.6%)	
- Do not know	36 (22.3%)	
Estrus reporting time		1.9 (p>0.05)
- < 6 Hours	42 (33.6%)	
- ≥ 6 Hours	83 (66.4%)	
Recognized estrus symptoms		
- Restless	8 (6.4%)	
- Vulvar mucus discharge	17 (13.6%)	
- Mounted by other cattle	28 (22.4%)	
- All correct signs	72 (57.6%)	

N = number of samples

Regarding estrus symptom recognition, only 57.6% of farmers used a combination of typical signs such as restlessness, vulvar mucus discharge, and mounting behavior. The remainder relied on individual signs, increasing the likelihood of missed or incorrect detection, especially in cases of silent estrus, a known challenge in reproductive management (Hojo *et al.*, 2018; Roelofs & Van Erp-van der Kooij, 2018). These findings indicate that while general estrus knowledge is relatively good, gaps in detection accuracy and timely reporting persist, likely contributing to the high repeat breeding rates observed in aceh cattle.

Maintenance Management Practices and

The results of structured interviews revealed that the majority of aceh cattle farmers in Pidie Regency still apply traditional maintenance practices that may predispose cattle to reproductive disorders, including repeat breeding (Table 3). Notably, 96.2% of farmers reported using soil floors for cattle housing, while only 3.7% used cement floors. The predominance of soil floors reflects suboptimal management practices that can increase the risk of poor hygiene and pathogen exposure, contributing to reproductive tract infections and infertility (Sadharakiya *et al.*, 2019; Bayne *et al.*, 2025).

Table 3. Overview of Maintenance Management Practices and Odds Ratios (OR) for Repeat Breeding in aceh Cattle, Pidie Regency

Parameter	N (%)	OR
Types of Cage Floor		0.21 (P>0.05)
- Soil	155 (6.2%)	
- Cement	6 (3.7%)	
Cage Cleanliness		0.65 (P>0.05)
- Clean	76(47.2%)	
- Dirty	85(52.7%)	
Drainage Availability		1.19 (P>0.05)

- Present	87(54.0%)	
- Absent	74 (45.9%)	
Water Source		3.97 (P<0.05)
- Well	130 (0.7%)	
- Others	31 (18.2%)	
Feeding and Drinking Facilities		0.18 (P>0.05)
- Present	139 (6.3%)	
- Absent	22 (13.6%)	
Maintenance system		0.61(P>0.05)
- Semi-intensive	61 (37.8%)	
- Extensive	100 (62.1%)	
Pregnant Cow Maintenance		0.37 (P>0.05)
- Semi-intensive	61(37.9%)	
- Extensive	100 (62.1%)	
Confinement before Parturition		0.20 (P<0.05)
- Confined	121(69.5%)	
- Not confined	49 (30.4%)	

N = number of samples

Cage cleanliness was also inadequate, with 52.7% of farmers admitting that their cattle pens were not clean, and only 54.0% had proper drainage systems. Inadequate drainage and poor pen hygiene have been strongly associated with an increased risk of reproductive tract infections such as endometritis, which is a known contributor to repeat breeding in cattle (Maulana *et al.*, 2022). Poor sanitation, particularly around the time of insemination, increases bacterial contamination, potentially leading to reduced conception rates.

Regarding water sources, 80.7% of farmers reported using well water, while 18.2% relied on alternative sources. Interestingly, the use of well water was significantly associated with repeat breeding (OR: 3.97; P < 0.05). Contaminated or low-quality water sources can compromise cattle health and fertility, as adequate water intake and quality are critical for maintaining metabolic balance, nutrient transport, and overall reproductive performance (El Mahdy *et al.*, 2016). In terms of pen facilities, 86.3% of farmers had designated feeding and drinking areas, indicating partial compliance with basic management standards. However, 13.6% lacked such facilities, which could affect the nutritional status of cattle and contribute to reproductive inefficiency.

The majority of farmers (62.1%) still practiced extensive cattle management, where animals graze freely with minimal supervision. While this system is traditional and cost-effective, it poses challenges for controlled breeding, health monitoring, and nutritional management, all of which can affect reproductive success (Sumadiasa *et al.*, 2024). Moreover, pregnant cattle managed extensively often experience suboptimal nutrition, relying primarily on low-quality feed sources such as rice straw, which is insufficient to meet the increased nutritional demands during gestation. Encouragingly, 69.5% of farmers reported that pregnant cattle approaching parturition were confined in pens, allowing for improved monitoring and care. Adequate penning of late-gestation cattle is essential to minimize calving-related complications and reduce stress, indirectly supporting subsequent reproductive performance.

These findings emphasize that improving basic cattle maintenance practices, such as pen hygiene, water quality, and controlled management of pregnant cattle, are crucial steps in reducing repeat breeding incidence in aceh cattle. Farmer education and intervention programs targeting these factors are essential to support reproductive efficiency in traditional cattle farming systems.

Association Between Risk Factors and Repeat Breeding in aceh Cattle

The relationship between potential risk factors and the occurrence of repeat breeding in aceh cattle was analyzed using Chi-square tests and odds ratio (OR) calculations. The results are summarized in Tables 2 and 3.

The analysis revealed that farmers' knowledge of estrus signs showed a significant association with repeat breeding (OR = 2.32; $P < 0.05$). Cattle managed by farmers who lacked adequate knowledge of estrus were 2.3 times more likely to experience repeat breeding compared to those whose owners had sufficient estrus detection knowledge. This finding is consistent with previous studies emphasizing that poor estrus detection is a major contributor to reduced reproductive efficiency in cattle (Widyastuti *et al.*, 2023). Inaccurate estrus identification often leads to improper timing of artificial insemination (AI), ultimately increasing the risk of conception failure and repeat breeding (Abdalla *et al.*, 2019).

Another significant factor identified was the source of drinking water (OR = 3.97; $P < 0.05$). Farmers who relied on non-well water sources, such as rivers or collected rainwater, had cattle with a 3.9-fold higher risk of repeat breeding compared to those using well water. Water quality and availability are crucial for maintaining optimal metabolic and reproductive functions in cattle. Insufficient or contaminated water sources have been linked to decreased body condition, impaired ovarian activity, and reduced fertility (El Mahdy *et al.*, 2016). Interestingly, cattle that were penned during the period approaching parturition had a significantly lower risk of repeat breeding (OR = 0.20; $P < 0.05$) compared to those that were not confined. Proper confinement of late-gestation cattle facilitates better supervision, reduces stress, and ensures appropriate nutritional supplementation, all of which positively influence reproductive performance postpartum (Orihuela & Galina, 2019).

In contrast, several other factors—including the timing of estrus reporting, pen floor type, drainage availability, pen cleanliness, presence of feeding and drinking facilities, and overall maintenance system—did not show statistically significant associations with repeat breeding in this study. These findings differ from some earlier reports, such as Prihatno *et al.* (2013), who observed significant associations between pen hygiene, floor type, and reproductive efficiency in cattle. The discrepancy may be attributed to variations in farming practices, cattle genetics, and environmental conditions across different regions.

These results emphasize the importance of improving farmer education on estrus detection and reproductive management. In particular, addressing limitations in estrus detection and promoting proper water management are critical steps toward reducing repeat breeding incidence and improving reproductive efficiency in aceh cattle. Furthermore, targeted interventions to encourage penning of cattle during late pregnancy could further support reproductive success.possibility of miscarriage.

Conclusion

This study revealed that the prevalence of repeat breeding in female aceh cattle in Pidie Regency reached 58.3%, indicating a significant reproductive problem among cattle managed by smallholder farmers in the region. The findings demonstrate that both mating and maintenance management practices contribute to the occurrence of repeat breeding. Specifically, inadequate farmer knowledge of estrus detection was identified as a significant risk factor, emphasizing the importance of farmer education and training to improve reproductive efficiency. Furthermore, the use of non-well water sources and the practice of not confining cattle approaching parturition were also associated with an increased risk of repeat breeding. In contrast, other factors such as maintenance system, pen floor type, drainage, pen cleanliness, feeding and drinking facilities, and estrus reporting time were not significantly associated with repeat breeding incidence.

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