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Original article

Determination of estrus in Aceh cows based on the van Eerdenburg method

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ABSTRACT

Accurate determination of estrus status in an animal based on an appropriate estrus detection method can guarantee the cows' pregnancy after mating. This study aims to determine the estrus status of Aceh cows using the van Eerdenburg estrus behavior scoring method. This study was conducted from 22 January to 12 February 2021, at the Technical Implementation Unit for Animals of the Faculty of Veterinary Medicine, Universitas Syiah Kuala, Banda Aceh, Indonesia. The sample used was eleven Aceh cows aged 4-6 years old. Parameters observed were the number of cows exhibiting signs of estrus using the estrus behavior scoring method. The accuracy of estrus detection was confirmed by palpation per rectum to detect the presence of uterine tone. By observing signs of estrus using the method studied, 90.9% (10/11) of the cows were determined to be in estrus. Confirmation by the presence of uterine tone showed a 100% accuracy rate. The most effective sign of estrus was the passivity of the cow when being ridden by another cow or bull. This study concluded that estrus status in local cows could be determined using the estrus behavior scoring of the van Eerdenburg method.

Keywords: cervical mucus, cow, estrus behavior, primary signs of estrus, standing estrus

INTRODUCTION

Aceh cows are the germplasm of Aceh province which have always played an essential role in the economic, social, and cultural life of Acehnese people in rural areas (Novita *et al*., 2018). Aceh cows were designated as native Indonesian cows in 2011 by the Minister of Agriculture of the Republico of Indonesian through the Decree of the Minister of Agriculture Number 2907/Kits/OT.140/6/2011. Increasing the population and genetic quality of Aceh cows could be done using artificial insemination techniques. Estrus physiology and observation of estrous behavior were critical in applying artificial insemination (Abidin *et al*., 2012) so that fertilization can be carried out at the right time (Jurame *et al*., 2018).

Estrus can be determined by looking for signs, such as a red, swollen vulva and clear mucus. The behavior of the cows during estrus was also accompanied by urination, lifting tail, bellowing, riding other cows and being silent when ridden by another cow, and not resisting

(standing estrus) (Layek *et al*., 2011). In cattle, visible signs of estrus were used to determine or estimate the proximity of the moment of ovulation (Roelofs *et al*., 2010). However, signs of estrus only sometimes appeared entirely, sometimes only partially, or not at all (Reith and Hoy, 2018). There are several scoring methods for estrus detection, with three (Rao *et al*., 2013) and five parameters (Sonmez *et al*., 2005).

However, van Eerdenburg *et al*. (1996) used nine parameter method to include some secondary estrus behaviors to anticipate if standing estrus as the main estrus symptom was not observed during estrus detection. This was an obstacle for smallholder farmers, who often make inaccurate observations of estrus through changes in behavior and external reproductive organs (Jannah *et al*., 2020). Based on the scoring, the detection of estrus in Aceh cows was related to the characteristics of the cervical mucus using an artificial insemination endoscope with a camera (Mulfristia *et al*., 2022).

The method of determining estrus was based on the accumulated scores of several behavioral components of cows going into estrus. A cow was designated as a cow in estrus if it collected a score of 50 with a frequency of detection of estrus two or three times a day. There was a relationship between estrus behavior scores and ovulation time in dairy cows (van Eerdenburg *et al*., 2002). Estrus in cows could be detected based on the tone of the uterus through rectal palpation. On the other hand, in cows that were not in estrus, the uterus was flaccid (Hansar *et al*., 2014). No studies have reported the use of a behavioral scoring method in Aceh cows for determining estrus status, which can be used as a guide by smallholder farmers. Therefore, it is necessary to conduct a study on determining estrus based on estrus behavior scores confirmed by uterine tone through rectal examination.

MATERIALS AND METHODS

This study was conducted at the UPT Experimental Animals, Faculty of Veterinary Medicine, Syiah Kuala University, Banda Aceh, from 22 January to 12 February 2021.

Design of the study

Determination of the cows samples was carried out by purposive sampling, where eleven cows were selected based on the criteria of adult cows aged 4-6 years, more than one parity, and not-pregnant. The study was conducted in the form of observation of the behavioral score of estrus.

Procedure

The sample cows to be observed were attached with identification collars. Synchronization of estrus was carried out using prostaglandin F2α (PGF2α, Lutalyse™ Zoetis, Belgium), which was injected twice at a dose of 25 mg/ml/cow intramuscularly (Budiasa and Pemayun, 2019) with an interval of 11 days. Twenty-four hours after the second PGF2α injection, signs of estrus were observed, and estrus behavior score was measured according to the van Eerdenburg *et al*. (1996) method. (Table 1).

Table 1 Criteria and scores for estrus behavior by van Eerdenburg *et al*. (1996)

no.	estrus behavior	score
1	vaginal mucous discharge	3
2	flehmen	3
3	nervous	5
4	ridden but moved away	10
5	sniffing the back of another cow	10
6	chin resting on the back of another cow	15
7	ride or try to ride another cow	35
8	ride another cow from the front	45
9	standing estrus behavior (allow other cattle to ride)	100

Cow observations and data recording were carried out three times a day, i.e., every morning (08.00-09.00 WIB), noon (12.00-13.00 WIB), and afternoon (16.00-17.00 WIB). A cow was determined in estrus based on a minimum total estrus behavior score of 50. Cows assigned to estrus were then confirmed for uterine tone by rectal palpation (López-Gatius and Camón-Urgel, 1991; Hansar *et al*., 2014).

Data analysis

Data on the observation of estrus behavior scores of the sample cows were analyzed descriptively and compared with uterine tone in rectal palpation.

RESULTS

The cows showed estrus behavior was seen being ridden but not stand still, restless while running and trying to gore other cows, sniffing other cow's back, resting their chins on other cows' backs, riding other cows, and being silent while being ridden (Figure 1). Estrus detection based on the score of estrus behavior obtained a total score of 0-160. A minimum score of 50, with additional symptoms of restlessness and decreased appetite, was confirmed by uterine tone by rectal palpation was 90.91% (10/11) (Table 2).

Table 2 Estrus detection based on the estrus behavior score by van Eerdenburg *et al*. (1996) and uterine tone by rectal palpation.

cow no.	estrus behavior score									total score	uterine tone	conclusion
	1	2	3	4	5	6	7	8	9			
1	-	+	+	+	-	-	+	-	+	153	+	estrus
2	-	-	+	+	+	-	+	-	+	160	+	estrus
3	-	-	-	+	+	-	+	-	+	155	+	estrus
4	-	-	-	-	+	-	-	-	+	110	+	estrus
5	-	-	-	-	+	-	+	-	+	145	+	estrus
6	-	-	-	-	-	-	-	-	+	100	+	estrus
7	-	-	-	-	-	-	-	-	+	100	+	estrus
8	-	-	-	-	-	-	-	-	+	100	+	estrus
9	-	-	+	-	-	+	+	-	-	55	+	estrus
10	-	-	+	+	+	-	+	-	-	60	+	estrus
11	-	-	-	-	-	-	-	-	-	0	-	not estrus

Table 3 Frequency of estrus behavior components based on estrus behavior scores

no.	estrus behavior	%
1	vaginal mucous discharge	0 (0/11)
2	flehmen	9.09 (1/11)
3	nervous	36.36 (4/11)
4	ridden but moved away	36.36 (4/11)
5	sniffing the back of another cow	45.45 (5/11)
6	chin resting on the back of another cow	9.09 (1/11)
7	ride or try to ride another cow	54.54 (6/11)
8	ride another cow from the front	0 (0/11)
9	**standing estrus** behavior (allow other cattle to ride)	72.72 (8/11)

In this study, signs of estrus with vaginal mucosal discharge (parameter no. 1) and riding other cows from the front (parameter no. 8) were not seen in all cows, which were later confirmed to be estrus or not by rectal palpation. Standing estrus was the most frequently observed

component of estrus behavior (72.72%), compared to other estrus behavior components (Table 3). However, two cows that were determined to be in estrus based on their uterine tone, did not exhibit standing estrus (Table 2).

DISCUSSION

Visual observation based on vulvar redness, wet swelling, and mucus discharge was helpful for the detection of estrous signs (Hayati *et al*., 2021). The thin, transparent, and watery mucus discharge from the vulva is a signal to the estrus dairy cows (Lim *et al*., 2014; Bernardi *et al*., 2016) and Egyptian Baladi cows (Damarany, 2020). In this study, ten cows that were in estrus did not secrete cervical mucus. However, previous reports stated that 22% (van Eerdenburg *et al*. 2002) and 100% (Baliarti *et al*. 2018) cows excrete cervical mucus during estrus. The difference in the percentage of cervical mucus discharge was probably caused by the higher volume of cervical mucus in the Holstein Friesian (HF) cow than in the beef cow. In addition, it was suspected that the discharge of cervical mucus in Aceh cows occured at night, while the observation was conducted during the day.

Figure 1 The cow showing estrus behavior: being ridden but moved away (A), restless, running and trying to gore another cow (B), sniffing another cow's back (C), rest her chin on another cow's back (D), riding another cow (E), and the cow was standing still while being ridden (F).

Some components of the estrus behavior in this study were different from previous publications. Anxious behavior manifested by decreased interest in food and the frequency and

duration of rumination was 36.36%, compared to 57.14% reported by Baliarti *et al*. (2018). Also, other components of the estrus behavior in this study, such as willing to ride but moved away, sniffing another cow, chin resting, riding or attempting to ride another cow, riding another cow from the front, were all lower than those of other studies (van Eerdenburg *et al*., 2002; Roelofs *et al*., 2010) which were respectively 36.36% vs 56%, 45.45% vs 100%, 9.09% vs 100%, 54.54% vs 90%, and 0% vs 22%.

Standing estrus was primary estrus behavior, the most definite and accurate sign of estrus cow (Diskin and Sreenan, 2000). A cow could be determined to be in estrus if it showed standing estrus at least three times in one observation (Roelofs *et al*., 2010) or six times in one detection (Esslemont and Bryant, 1976). In this study, two estrus cows did not show standing estrus even though uterine tone per rectal examination revealed estrus. Some estrus cows did not show standing estrus during estrus (Roelofs *et al*., 2010). Standing estrus was not the only sign of estrus shown during estrus (Baliarti *et al*., 2018). Standing estrus behavior in this study was 72.72% compared to 37% (van Eerdenburg *et al*., 2002), 56% (Roelofs *et al*., 2010), and 30-70% (Diskin and Sreenan, 2000).

This behavioral study was conducted on beef cows reared in the tropics. Thereby, it showed differences in the percentage of some components of estrus behavior with those of HF dairy cows reared in sub-tropical climates (van Eerdenburg *et al*., 2002; Roelofs *et al*., 2010). According to Baliarti *et al*. (2018), signs of estrus in some cows were incomplete due to the influence of maintenance, especially at the level of farmers who raised cows with minimal feed. Adequacy of crude protein was very important for the expression of estrus signs for optimizing reproductive performance (Hayati *et al*., 2021).

In addition to the behavior mentioned above, cows that are in estrus showed signs of reddened vulva (71.42%), swollen vulva (57.14%), and bellowing (42.85%) (Baliarti *et al*., 2018), decreased appetite, more restless, and more often standing than lying down. Forty-four percent of cows in estrus showed flehmen, i.e., raising their lips and head to catch chemical signals (pheromones) (van Eerdenburg *et al*., 2002; Roelofs *et al*., 2005).

The estrous status of cows can be determined based on the estrus behavior scoring method. The van Eerdenburg method allows smallholder farmers to detect cows in heat even without symptoms of standing estrus by accumulating at least 55 points that include only the appearance of secondary symptoms of estrus. The accuracy of the Van Eerdenburg estrus detection method in this study reached 100% when uterine tone was ascertained. Reproductive organ tone in estrus was related to the presence of ovulatory follicles through rectal observation (van Eerdenburg *et al*., 1996) and evaluation of follicular development using ultrasound (Hansar *et al*., 2014).

CONCLUSION

Determination of estrus status in Aceh cows could be based on the van Eerdenburg estrus behavior scoring method. The cows were estrus if they got a score of 55 or more. The three most frequently observed signs of estrus were standing to be ridden, ride or try to ride another cow, and sniffing another cow.

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