Original Article

Correlation between body condition score with estrus and reproductive performance in dairy cow post ovary hypofunction

Aqil Adyatama, Anis Muktiani, and Daud Samsudewa*

Faculty of Animal Science and Agriculture, Diponegoro University, Semarang, 50275, Indonesia
*Correspondence: daudreproduksi@gmail.com

Abstract

Objective: The objective of this research is to determine the relationship between body condition score (BCS) with estrus performance and reproductive performance in dairy cow post ovary hypofunction.
Methods: Observational method by collecting primary and secondary data were used in this research. Primary data includes BCS and estrus performance. Secondary data includes reproductive performance. Purposive sampling method with criteria minimum parity 1 were used. Correlation and simple linear regression were used to analyze the data.
Results: The results showed moderate correlation coefficient and regression equation of BCS with redness of vulva (0.531 and Y = 1.389+0.958 X), behavior changing (0.597 and Y = 0.75+0.896 X), mucus cervix intensity (0.503 and Y = 0.889+1.583 X), uterine erection (0.597 and Y = 1.500+1.792 X), service per conception (0.459 and Y = 4.33–1.09 X), estrus post-partum (0.594 and Y= 202.3–38.831 X) and days open (0.498 and Y= 217.271–40.832 X).
Conclusions: The conclusion of this research is dairy cow with minimum BCS 3 is needed during mating post ovary hypofunction.

Keywords: Correlation; Body condition score; Estrus performance; Reproduction performance

INTRODUCTION

The maintaining of pregnancy cycle of cows is the important key in dairy farms. The low success mating is the biggest problem in dairy farms. Artificial insemination (AI) is one of the problems solving for the low success mating [1]. AI is the method to deposit the semen of bull into reproductive organs of cows during estrus. The evaluation of AI can be done by measuring service per conception (S/C) with the standard <2 and the days open not more than 120 days [2]. The reproductive efficiency of cows on smallholder dairy farms is low with S/C 3.0±0.5 and days open

154.5±61.4 days. The low of reproductive efficiency affected by cow physiology, frozen semen quality, farmer behavior and integrity of inseminator.

The cow physiology is one factor determine the successfully rate of AI [3]. The ideal BCS of dairy cows as AI acceptors is 2.5 to 3.5 with the range BCS 1-5 [4]. BCS (body condition score) is indication of body fat and energy deposition that check in the tail, backbone, ribs, rump, pin and hips parts [5]. The ideal BCS of dairy cows is affected by feed supply and consumption during pregnancy and mating preparation. The feed consumption will ensure the sufficiency of

protein and energy content to supply the pregnancy and parturition requirement [6]. The fat and energy deposition in the body is connected with reproduction hormone production. The low of BCS score will increase the reproductive disorders especially hypofunction ovary in dairy cows [7]. The hormone production of dairy cows will relate with estrus sign. The obvious of estrus sign in dairy cow will support the successfully mating. The successfully mating will support the reproductive performance.

Research on the relationship between BCS with estrus and reproductive performance after ovarian hypofunction occurs is important to support the scientific information.

MATERIALS AND METHODS

Time and place of research

The research was conduct from August to October 2022. The research conducted at the local farmers of Ngablak District, Magelang Regency.

Materials

Forty-five dairy cows post ovary hypofunction minimum parity 1 who had received medical treatment were used in this research. Recording reproduction, rope, gloves, tissue and alcohol were used in this research.

Methods

Observational method by collecting primary and secondary data were used in this research. Primary data includes body condition score (BCS) and estrus performance. Reproductive performance of dairy cows is the secondary data in this research. This research used purposive sampling method with criteria minimum parity 1 of dairy cows.

Observed parameters

Body condition score, estrus performance and reproductive performance of dairy cows was observed. Body condition score observed by palpation of head tail, hooks, rump, pins, ribs, back and shoulder palpation (score 1 to 5). Estrus performance was observed by checking of vulva redness (1 to 4), behavior

change (- or +), mucus cervix intensity (1 to 4) and uterine erection (1 to 4). Service per conception (S/C), estrus post-partum (EPP) and days open (DO) is the parameters observed for reproductive performance. Service per conception (S/C) is the number of mating up to pregnancy of dairy cow [9]. The service per conception (S/C) was counted use the equation:

$$S/C = \frac{(\text{Total mating to pregnant cattle})}{(\text{Total number of pregnant cattle})} ...(1)$$

Days open (DO) is the period between parturition and next pregnancy [10]. Estrus post-partum (PPE) is the first estrus or ovulation after parturition [10].

Data analysis

Regression and correlation statistical analysis were used to analyze the data. Standard of coefficient correlation is 0-0.20 (very weak); 0.21-0.40 (weak); 0.41-0.60 (moderate); 0.51-0.80 (strong) and 0.81-1.00 (very strong). The SPSS 26.0 statistical analysis program used to support the data analysis.

RESULTS

Relationship of body condition score and estrus performance of dairy cow post ovary hypofunction

Vulva redness, behavior changing, mucus cervix intensity and uterine erection is parameters measured in this research. The score and percentage of the estrus performance in dairy cow with different BCS showed in Table 1. The coefficient correlation of body condition score and estrus of dairy cow post ovary hypofunction showed in Table 2.

The regression and correlation statistical analysis showed that the coefficient correlation of BCS and vulva redness of dairy cow during estrus is 0.531 and classified moderate correlation with the regression equation:

$$Y = 1.389 + 0.958\,X \qquad ......(2)$$

which means that increasing 1 score of the BCS will increase of 0.958 score of vulva redness of dairy cow during estrus. The coefficient of determination is 0.282 which

Table 1. Number and percentage of estrus performance of dairy cow in different BCS

BCS (head)	Color of vulva (%)				Behavior (%)		Mucus intensity (%)				Uterine erection (%)			
	1	2	3	4	−	+	1	2	3	4	1	2	3	4
2 (n=15)	6	-	66	28	87	13	6	66	-	28	-	93	-	7
2.5 (n=24)	-	-	-	100	54	46	-	50	-	50	-	50	-	50
3 (n=6)	-	-	-	100	-	100	-	-	-	100	-	-	-	100

Color of vulva (1= pale; 2 = slight red; 3 = red; 4 = very red), Behavior: 1 = (no behavior changing; 2 = behavior changing), Mucus Intensity (1= not mucus; 2 = little; 3 = slight abundant; 4 = abundant), Uterine erection (1 = no erection; 2 = hard; 3 = stiff; 4 = very stiff).

Table 2. The coefficient correlation of body condition score and estrus of dairy cow post ovary hypofunction

Variable	Coefficient correlation (r)	Coefficient determination (R)
Color of vulva	0.531	0.282
Behavior	0.597	0.357
Mucus intensity	0.503	0.253
Uterine erection	0.597	0.357

means that the effect of BCS on vulva redness of dairy cow during estrus is 28.2%.

The regression and correlation statistical analysis showed that the coefficient correlation of BCS and behavior changing of dairy cow during estrus is 0.597 and classified moderate correlation with the regression equation:

$$Y = 0.75 + 0.896\,X \quad ……(3)$$

which means that increasing 1 score of the BCS will increase of 0.896 score of behavior changing of dairy cow during estrus. The coefficient of determination is 0.357 which means that the effect of BCS on behavior changing of dairy cow during estrus is 35.7%.

The regression and correlation statistical analysis showed that the coefficient correlation of BCS and mucus cervix intensity of dairy cow during estrus is 0.503 and classified moderate correlation with the regression equation:

$$Y = 0.889 + 1.583\,X \quad ……(4)$$

which means that increasing 1 score of the BCS will increase of 1.583 score of mucus cervix intensity of dairy cow during estrus. The coefficient of determination is 0.253 which

means that the effect of BCS on mucus cervix intensity of dairy cow during estrus is 25.3%.

The regression and correlation statistical analysis showed that the coefficient correlation of BCS and uterine erection of dairy cow during estrus is 0.597 and classified moderate correlation with the regression equation:

$$Y = 1.500 + 1.792\,X \quad ……(5)$$

which means that increasing 1 score of the BCS will increase of 1.792 score of uterine erection of dairy cow during estrus. The coefficient of determination is 0.357 which means that the effect of BCS on uterine erection of dairy cow during estrus is 35.7%.

Relationship of body condition score and reproductive performance of dairy cow post ovary hypofunction

Service per conception, days open and estrus post-partum is parameters measured in this research. The number and percentage of the reproductive performance in dairy cow with different BCS showed in Table 3. The coefficient correlation of body condition score and reproductive performance of dairy cow post ovary hypofunction showed in Table 4.

Table 3. Reproductive performance of dairy cow in different BCS

BCS (head)	Reproductive performance		
	Service/conception (time)	Estrus post partum (days)	Days open (days)
2 (n=15)	2.40±0.50	135.2±19.05	144.6±18.89
2.5 (n=24)	1.75±0.66	105.5±37.16	114.1±38.93
3 (n=6)	1.50±0.76	66.2±5.32	73.8±5.34

Table 4. The coefficient correlation of body condition score and reproductive performance of dairy cow post ovary hypofunction

Variables	Coefficient Correlation (r)	Coefficient Determination (R)
Service/Conception	0.459	0.211
Estrus Post Partum	0.594	0.353
Days Open	0.498	0.348

The regression and correlation statistical analysis showed that the coefficient correlation of BCS and service per conception of dairy cow is 0.459 and classified moderate correlation with the regression equation:

$$Y = 4.33 - 1.09\ X \qquad ……(6)$$

which means that increasing 1 score of the BCS will decrease of 1.09 times of service per conception of dairy cow. The coefficient of determination is 0.211 which means that the effect of BCS on service per conception of dairy cow is 21.1%.

The regression and correlation statistical analysis showed that the coefficient correlation of BCS and estrus post-partum of dairy cow is 0.594 and classified moderate correlation with the regression equation:

$$Y = 202.3 - 38.831\ X \qquad ……(7)$$

which means that increasing 1 score of the BCS will decrease of 38.831 days of estrus post-partum of dairy cow. The coefficient of determination is 0.353 which means that the effect of BCS on estrus post-partum of dairy cow is 35.3%.

The regression and correlation statistical analysis showed that the coefficient correlation of BCS and days open of dairy cow is 0.498 and classified moderate correlation with the regression equation:

$$Y = 217.271 - 40.832X \quad ……(8)$$

which means that increasing 1 score of the BCS will decrease of 40.832 days of days open of dairy cow. The coefficient of determination is 0.348 which means that the effect of BCS on days open of dairy cow is 34.8%.

DISCUSSION

The results of this research showed increase in the BCS score in dairy cows makes the redness of vulva is more pronounced. Dairy cows with BCS 3 show a strong redness of vulva, but cattle with a BCS below 2.5 have a pale color [11]. One of the factors other than BCS that affect the redness of vulva is the consumption of nutrients. Adequate nutrition will increase the BCS as the lipid deposition. The increasing of lipid deposition will increase the cholesterol synthesize and followed by increasing of steroid hormone [12]. The increasing of steroid hormone will stimulate the alteration of adrenalin hormone that affected to the increasing of heart beat. Increasing of the heart beat will increase the blood flow in blood vessel. This condition will increase the redness of vulva in the thin skin including vulva.

During estrus, the adrenalin hormone will escalate along with increasing of estrogen. The effect of the adrenalin escalation is behavior changing of dairy cows including decreasing appetite, restless and standing heat. The results of this research showed that 87% of dairy cows with BCS 2 did not show (-) behavior changing and 13% showed (+) behavior changing. Dairy cows with a BCS of 2.5 as much as 54% did not

show behavior changing (-) and as many as 46% showed behavior changing (+). In the other hand, all of the dairy cows with BCS 3 in this research show behavior changing (+). The behavior changing of dairy cows also affected by nutrient consumption and environment besides BCS. One of the nutrient contents of the feed which plays a role in synthesizing reproductive hormones is lipid, the lipid contained in the nutrient content of the feed is utilized by the gonads and adrenal glands which are then secreted in the form of cholesterol [13]. Steroid hormones are synthesized by cholesterol in their formation [14].

The results of this research showed dairy cows with BCS 2 are cows with the lowest mucus cervix intensity. Mucus cervix intensity is influenced by estrogen and adrenaline hormone that stimulate the secretion of oxytocin hormone, then the oxytocin hormone will contract the endothelial cells of the blood vessels become permeable which increases the activity of goblet cells [15, 16]. The amount of vaginal mucus secreted was due to the accumulation of liquid in the goblet cells, increasing goblet cell pressure resulted in cell rupture and mucus cervix expulsion.

Uterine erection is an effect of escalation of estrogen level that followed by increasing of prostaglandin. Prostaglandin is one of the hormones that responsible with muscle tension including in uterine. Uterine erection is the sign of cow ready to be mated [17]. In this research, 93% of dairy cows with BCS 2 showed hard uterine erection (score 2) and 7% had very stiff uterine erection (score 4). Dairy cows with BCS 2.5 as much as 50% showed hard uterine erection (score 2) and some showed very stiff uterine erection (score 4). Dairy cows with BCS 3 all showed very stiff uterine erection (score 4).

The results of this research showed that the optimum reproductive performance is dairy cows with BCS 3. The dairy cows with BCS 3 shown service per conception, estrus post-partum and days open < 2 times, 70 days and 80 days, respectively. Dairy cows with good reproductive performance have normal S/C values ranging from (1.6-2.0), estrus post-partum no more than 85 days and days open less than 120 days [18]. Nutrient components are one of the factors affected to the reproductive performances beside BCS. Protein and lipid are the substrate for reproduction hormones synthesize. Follicle Stimulating hormones (FSH) and luteinizing hormone (LH) is one of the reproduction hormones secrete by hypophysis that stimulate by gonadotrophin releasing hormone (GnRH) from hypothalamus. FSH and LH secreted by hypophysis and stimulated by GnRH will activate reproductive hormones in the ovaries and affect to the success rate of pregnancy [20]. Nutrient components are not only about protein and lipid sufficiency, but also need to concern with micro and macro mineral fulfillment including magnesium, selenium and zinc.

CONCLUSIONS

The conclusion of this research is dairy cow with minimum BCS 3 is needed during mating post ovary hypofunction. The minimum BCS 3 for dairy cows before mating will support the increasing of estrus and reproductive performance. Ensuring the feed sufficiency is important factor to increase reproductive performance including macro and micro mineral.

CONFLICT OF INTEREST

We stated that in writing this article has no conflict of interest relating to finance, personal, or other related organizations material written in the script.

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