

## The correlation of body condition score (BCS) to estrus expression (A case study in Friesian Holstein crossbreed dairy cows at KAN Jabung, Malang)

*Korelasi body condition score (BCS) terhadap ekspresi birahi (Studi kasus pada sapi perah peranakan Friesian Holstein di KAN Jabung, Malang)*

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### ABSTRACT

This study aimed to determine the relationship between body condition score (BCS) and estrus expression. The study was conducted by measuring BCS and observing estrus expression in the vulva (color change, swelling, increased temperature, and mucus secretion) before artificial insemination. BCS was assessed using a 5-point interval scale. This study was conducted on 20 Friesian Holstein crossbreed dairy cows that showed signs of estrus and had given birth (first lactation) or were older than 3 years. There was a correlation between BCS and several estrus indicators in the vulva: color change ( $r=0.70$ ), increased temperature ( $r=0.91$ ), mucus secretion ( $r=0.77$ ), and swelling ( $r=0.50$ ). Cows with a low BCS showed poor estrus quality, while cows with a moderate BCS showed more pronounced estrus symptoms. This suggests that inadequate nutrition in cows with a low BCS can lead to hormonal imbalance and suboptimal reproductive performance. Therefore, it is important to increase livestock farmers' awareness of the importance of providing sufficient and quality feed to meet livestock nutritional needs and achieve optimal reproductive performance.

### ABSTRAK

Penelitian ini bertujuan untuk mengetahui hubungan antara body condition score (BCS) dengan ekspresi birahi. Penelitian dilakukan dengan mengukur BCS dan mengamati indikator birahi pada vulva (perubahan warna, pembengkakan, peningkatan suhu, dan sekresi lendir) sebelum dilakukan inseminasi buatan. BCS dinilai menggunakan skala interval 5 poin. Penelitian ini dilakukan pada 20 ekor sapi perah peranakan Friesian Holstein yang menunjukkan tanda-tanda birahi dan telah pernah melahirkan (laktasi pertama) atau berusia lebih dari 3 tahun. Terdapat korelasi antara BCS dengan beberapa indikator birahi pada vulva: perubahan warna ( $r=0,70$ ), peningkatan suhu ( $r=0,91$ ), sekresi lendir ( $r=0,77$ ), dan pembengkakan ( $r=0,50$ ). Sapi dengan BCS rendah menunjukkan kualitas birahi yang buruk, sedangkan sapi dengan BCS sedang menunjukkan gejala birahi yang lebih jelas. Hal ini menunjukkan bahwa nutrisi yang tidak mencukupi pada sapi dengan BCS rendah dapat menyebabkan ketidakseimbangan hormon dan kinerja reproduksi yang tidak optimal. Oleh karena itu, penting untuk meningkatkan kesadaran peternak akan pentingnya pemberian pakan yang cukup dan berkualitas agar kebutuhan nutrisi ternak terpenuhi dan performa reproduksi optimal.

**Kata kunci:**  
Inseminasi buatan  
Body condition score (BCS)  
Indikator birahi  
Sapi perah peranakan  
Friesian Holstein (PFH)



## INTRODUCTION

Koperasi Agro Niaga (KAN Jabung) currently has approximately 2,423 active members. It is located in Jabung District, Malang Regency, East Java. The role of the KAN Jabung in increasing productivity and production efficiency in the livestock business is to provide counseling on management improvements, the provision of animal feed and its quality and quantity, the provision of animal health officers, the procurement of superior seeds and most importantly, the procurement of artificial insemination (AI) programs to increase livestock populations.

Many problems were encountered during the implementation of the artificial insemination program, thus hindering its progress. The first problem experienced is that many of the farmer members' livestock exhibit members symptoms of vulval expression or oestrus expression of poor quality, which will later impact the success rate of artificial insemination (Hafizuddin et al., 2012). The second problem is that farmer members own a large number of livestock with a relatively low to medium body condition score (BCS). The long dry season decreases the supply of forage for animal feed, while the expression of oestrus is influenced by the nutritional status of the livestock and is related to reproductive hormones (Sya'adah et al., 2022). So far, no observations have been made regarding the correlation between BCS and oestrus expression in Friesian-Holsteins. Therefore, the aim of this study was to investigate the correlation between BCS and oestrus expression in dairy cows at KAN Jabung in East Java. The results will be used to inform farmers on how to improve nutrition and feed to produce good quality oestrus expression in dairy cows.

## MATERIALS AND METHODS

### Material

The equipment used for this observation activity included cages, measuring instruments, thermometers, gloves, cameras and stationery. The cattle used in this observation were selected based on their oestrus expression, with up to 20 Friesian-Holstein crossbreed dairy cattle being

used. The cattle were chosen based on their body condition score (BCS), with the criteria being that they had given birth before (lactation 1) or were more than three years old.

### Methods

The method involved collecting primary data in the form of BCS measurements and observations of estrus expression in the appearance of the vulva (e.g., discolouration, swelling, temperature, and mucus secretion), which occurs before artificial insemination. The Animal Health Officer performs artificial insemination 9–12 hours after the farmer member reports it, which is either at night for insemination the next morning or in the morning for insemination that afternoon.

### Experimental Design

#### Measurement of body condition score

Perform BCS measurements and assessments in livestock, accompanied by Animal Health Officers. The first observation covered eight points on the body of the livestock, including: processes spinosus and transversus, the ischial coxae (hooks), the space between the tuber coxae and tuber sciadicus (pins), the space between the right and left tuber coxae, and the base of the tail and the tuber sciadicus. After determining the BCS, the cattle were recorded on the form and their oestrus expression was observed. The body condition score categories for livestock are shown in Table 1.

#### Appearance of the vulva

The appearance of the vulva was assessed when the cattle exhibited oestrus behaviour within 9–12 hours of the onset of estrus (prior to artificial insemination). The first step in the examination was to measure the degree of swelling, followed by gently opening the labia majora to check for any discolouration of the labia minora and to evaluate the quantity of mucus secreted from the vulva. After observation, the labia majora were closed again, and a digital thermometer was inserted into the vulva to measure its temperature. All data collected were recorded on the observation form.

Table 1. Body condition score category in livestock using an interval scale 5 according to Mulyanti (2021)

| BCS Score | Description                                                                                                                                                                                                                                                                            |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         | The cattle are classified as very thin, with characteristics such as a shrinking of the base of the tail, a very protruding vulva, and clear segments between the tailbones.                                                                                                           |
| 2         | The cattle are classified as very thin, with characteristics such as a shrinking of the base of the tail, a very protruding vulva, and clear segments between the tailbones.                                                                                                           |
| 3         | The cattle are classified as medium. They have a flatter-looking vulva, a closed rectum, and no fat deposits. Their tailbones appear rounded, and the spinous processes of the spine can be felt by pressing on them. The tuber coxae and tuber ischiadicus appear rounded and smooth. |
| 4         | The cattle are classified as fat. The characteristics of the spinous process can only be felt with very strong pressure. The tuber coxae are finely rounded. The ischiadicus tuber area looks dense, and there are fat deposits. The hungry leg looks flat.                            |
| 5         | The cattle are classified as being very fat, with characteristic fat accumulations in the costal and coccygeal regions. The coccyx is not visible.                                                                                                                                     |

The parameters used in this activity were as follows:

a. Discoloration of the vulva

Assessing the appearance of vulvar color when cattle experience estrus expression based on research conducted by Ismaya (2014), namely by opening the vulva labia major to look at the color of the vulva labia minor, with the determination of color change scores as follows:

- Score 1: Faded red color with peripheral blood vessels not visible  
 Score 2: Uneven red color with peripheral vessels clearly visible  
 Score 3: Even red color with peripheral vessels very clearly visible

b. Vulva Reliability Measurement

Measuring the vulva when cattle estrus expression by measuring the length of the vulva using a 0.1cm accuracy level meter, the measurement carried out is the horizontal direction from the right end to the left end of the vulva.

c. Vulvar Temperature Measurement

Measuring the temperature of the vulva when cattle estrus expression using a digital thermometer (Celsius) inserted into the vulvar hole and left for 3 minutes with a sensitivity level of 0.1 as deep as 3-5 cm (Indira et al., 2014).

d. Mucus Secretion

Observing the intensity of mucus secretion that comes out on the vulva during estrus expression, based on research that had been done by Lim et al. (2014) with the determination

of the score of outgoing mucus secretion as follows:

Score 1: No mucus coming out on the vulva

Score 2: Mucus that comes out only slightly in the vulvar area

Score 3: Mucus that comes out a lot to drip

e. Correlation Test

Correlation tests using Rank Spearman Methods were useful for measuring the strength of the relationship between two variables (sometimes more than two variables). The correlation formed between these variables could be a positive or negative relationship; it could be seen based on the value of the correlation coefficient whether it was plus (+) or minus (-). The positive relationship if variable (X) increases, variable (Y) also increases, while the negative relationship if variable (X) decreases, but variable (Y) would increase. According to Pratisto (2004) the guidelines for providing the interpretation of the correlation coefficient as shown in Table 2.

Table 2. Correlation coefficient with the relationship level

| No. | Correlation coefficient | Relationship level |
|-----|-------------------------|--------------------|
| 1.  | 0.00-0.199              | Very low           |
| 2.  | 0.20-0.399              | Low                |
| 3.  | 0.40-0.599              | Keep               |
| 4.  | 0.60-0.799              | Strong             |
| 5.  | 0.80-1.000              | Very powerful      |

### Data Analysis

The data analysis used descriptive analysis for the measurement of BCS, while for observational data on the appearance of the vulva, such as color changes, swelling, temperature rise, and mucus secretion were tabulated to determine the relationship with the BCS of livestock. The coefficients of determination were described descriptively.

## RESULTS AND DISCUSSION

### Measurement of Body Condition Score

Assessment of body condition in dairy cows is visual and tactile, and evaluation of body fat reserves is made using a 5-point scale, with each increase of 0.25 points. Based on the observations that have been made, the following results are shown in Table 3:

From Table 3, it can be seen that livestock owned by members of the KAN Jabung have a relatively low to medium BCS of 1.5, 2, 2.5, and 3 on a scale of 5. Measurement of livestock BCS is very necessary to determine the amount of nutrients consumed until the livestock is in optimal condition. Livestock that have a BCS of 1.5 and 2 are classified as low grade, or in other words, cattle have a thin body. Some of the reasons that cause the low BCS owned by livestock include that some farmer members still do not pay attention to livestock maintenance management and feeding management, such as not meeting the nutritional needs of the feed in livestock. The feed given is only in the form of makeshift forage obtained from the surrounding environment and concentrates.

A low BCS in livestock can have an impact on performance in reproduction, pregnancy, milk

production, and the health and development of offspring. This is confirmed by Abidin et al. (2012), if farms are maintained using traditional maintenance systems with moored models and forage feed is only given sober without paying attention to nutritional quality, then livestock will experience a lack of nutrients needed for reproductive activities. This sober feeding is due to many factors, one of which is the limitation of fresh forage due to a long drought that makes farmers have to buy forage as feed stock and not all farmer members can afford to buy forage feed.

Livestock that have a BCS of 2.5 and 3 are classified as medium grade cattle or with conditions that are not fat and not thin, this is because farmer members have improved feed management by meeting the nutritional needs of livestock, such as providing good quality forage adding concentrates with sufficient protein levels and providing other additional feed such as afkir bread and beer grounds. According to the statement of Wandura et al. (2020) that the provision of beer dregs and afkir bread is an effective supporting feed for livestock because it has a high enough protein content, but the purchase price is still affordable for farmers.

Efforts to improve the BCS in livestock can be made by providing forage and concentrate regularly according to their needs. In addition to forage and concentrates, the addition of additional feed for livestock can also help in improving feed nutrition, which is supported by Marume's statement (2014) supplementary feed in livestock can improve body condition and significantly improve estrus expression, so that it can cause re-fertilization in livestock.

During maintenance, especially during mating, pregnancy, and lactation, adequate

Table 3. Body condition score (BCS) measurement in livestock

| BCS Score | Sum     | Description                                                                                                                                                                                                    |
|-----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.5       | 5 tails | The cattle are categorised as very thin due to the following characteristics: prominent vulva, angular hook, and clearly visible tailbones.                                                                    |
| 2         | 5 tails | The cattle are classified as thin, with vulval protrusions that are not excessive. The tuber coxae and tuber ischiadus protrude, but the space between them is not overly concave. There is no fat on the pin. |
| 2.5       | 5 tails | The cattle are classified as thin, with characteristics almost identical to those of BCS 2. However, there is little fat on the pin.                                                                           |
| 3         | 5 tails | The cattle are classified as medium-sized and their tailbones or hooks appear rounded, with their coccyx segments looking filled with fat.                                                                     |

nutrition can facilitate the reproductive process (Amin, 2014). Therefore, it is important for farmers to ensure that their livestock get balanced and adequate nutrition for growth and reproduction to run well. Good feed planning and regular monitoring of livestock health are very important to maintain an optimal condition, which is in accordance with BCS Lalman's statement in Kafi et al. (2022) livestock that are given feed that suits their needs will have a good BCS, high fertility rate, and increased productivity.

### Discoloration of the Vulva

Changes in vulvar color when cattle estrus expression are changes that occur in the vulva labia minor. The results of observations of vulvar color changes in dairy cows of the Friesian Holstein breed are listed in Table 4.

Table 4. Discoloration of the vulva

| Sample | BCS 1.5 | BCS 2 | BCS 2.5 | BCS 3 |
|--------|---------|-------|---------|-------|
| 1      | 1       | 2     | 3       | 2     |
| 2      | 1       | 2     | 2       | 3     |
| 3      | 2       | 1     | 3       | 3     |
| 4      | 2       | 3     | 2       | 3     |
| 5      | 1       | 1     | 3       | 3     |
| Yes    | 7       | 9     | 13      | 14    |
| Ni     | 5       | 5     | 5       | 5     |

Description: Si= many occurrences of estrus expression value (score) in the i-th BCS;

ni = many i-th samples

Based on the table shows that some livestock that have a BCS of 1.5 and 2 (low) have the most frequency of pale red color changes, amounting to 5 out of 10 livestock for the rest, namely 4 heads show uneven red changes and only 1 head shows even red color changes, this is because the feed nutrients provided do not meet the needs of their livestock so that there is a hormonal imbalance in the body of cattle that gives rise to differences in blood circulation in the vulvar area (Saara et al., 2011). In addition, uneven color changes in the vulva can also be due to genetic factors in the physiology of livestock.

Livestock that have a BCS of 2.5 to 3 (medium) shows the frequency of evenly distributed red color changes at most, amounting

to 7 out of 10 cattle for 3 other heads, which shows an uneven red color, this is because livestock have sufficient feed nutrients so that the hormonal mechanism runs perfectly, the higher the estrogen hormone produced, the higher the quality of estrus expression produced (Ridlo et al., 2018).

In general, livestock that exhibit estrus expression will experience discoloration of the vulva, such as evenly red, uneven red, and pale pink. Changes in vulvar color in cattle during estrus expression are a sign that can be applied in knowledge about estrus and livestock fertility; besides that, color change is one of the most accurate indicators to determine the phase of livestock estrus expression because it is related to the activity of the hormone estrogen during estrus (Lestari, 2014). According to Purwasih et al. (2014) the color of the vulva becomes red; this is due to when the level of estrogen in the blood has increased, it will also increase adrenaline hormones, which later trigger the heart rate and constrict blood vessels so that blood circulation increases.

### Vulva Swelling

The results showed that when cattle experience estrus, they will experience swelling of the vulva, which can be seen by increasing the size of the vulvar gap. The results obtained from the measurement of vulvar vascularity are listed in Table 5.

Table 5. Results of vulvar swelling measurement

| Sample | BCS 1.5 | BCS 2 | BCS 2.5 | BCS 3 |
|--------|---------|-------|---------|-------|
|        | (cm)    |       |         |       |
| 1      | 3.8     | 4.2   | 5.4     | 5.4   |
| 2      | 3.6     | 4.5   | 4.9     | 6.1   |
| 3      | 3.7     | 3.9   | 4.9     | 5.7   |
| 4      | 4.4     | 4.7   | 4.4     | 6.2   |
| 5      | 3.8     | 4.4   | 5.7     | 5.9   |
| Total  | 19.3    | 21.7  | 24.3    | 29.3  |
| Track  | 3.9     | 4.3   | 4.9     | 5.8   |

It can be seen in Table 5 that the enlargement of the size of vulvar swelling in cattle that have a BCS of 1.5, 2, 2.5, and 3 has an average swelling of 3.9, 4.3, 4.9, and the last

5.8. On the increase in vulvar swelling, it can be seen that the swelling increases with the level of the BCS of cattle. Cattle with the highest BSC have the most swelling, and cattle with a low BSC have the least vulvar swelling. In addition, there are some cattle even though they are in estrus expression but do not experience swelling of the vulva. According to Adiati et al. (2013) explained that this can occur due to several factors, such as hormonal conditions (disruption of estrogen and progesterone), excessive stress, lack of feed, inappropriate environmental conditions (non-optimal temperature, soiling, and lack of space). It can be seen from the factors that have been mentioned when cattle have a low BCS, cattle can experience vulvar swelling that is not optimal during estrus expression.

Swelling of the vulva can occur due to the effect of the work of the hormones cortisol and epinephrine together, increasing blood pressure in the capillaries. High blood concentrations can cause increased capillary permeability, which is what makes plasma proteins exit the blood vessels into the interstitium space. According to Marbun et al. (2015) plasma proteins that continue to come out will accumulate because of edema, or in other words, swelling. Vulvar swelling also continues to increase at the peak of estrus expression, which is when optimal vulvar swelling measurements are made.

### Vulva Temperature Ascension

One sign of livestock estrus expression is an increase in temperature in the vulva of livestock. The results of observations that have been made, obtained the results of an increase in vulvar temperature during estrus expression, are as follows in Table 6.

Table 6. Results of temperature measurement on the vulva

| Sample | BCS 1.5 | BCS 2 | BCS 2.5 | BCS 3 |
|--------|---------|-------|---------|-------|
|        | (°C)    |       |         |       |
| 1      | 38.4    | 38.4  | 38.6    | 38.8  |
| 2      | 38.5    | 38.6  | 38.9    | 39.1  |
| 3      | 38.4    | 38.4  | 38.6    | 38.8  |
| 4      | 38.3    | 38.3  | 38.4    | 39.1  |
| 5      | 38.6    | 38.8  | 38.7    | 38.9  |
| Total  | 192.2   | 192.5 | 193.2   | 194.7 |
| Track  | 38.4    | 38.5  | 38.6    | 38.9  |

The vulva temperature in cattle with different BCS produces the same front number at 38°C, but there is a difference in the number behind the comma. This is because the vulvar temperature at the time of estrus expression will increase in a relatively small magnitude. According to Widiyono et al. (2011), cattle that are in estrus expression have a higher body temperature, ranging from 0.3 to 1.3 than normal, while the normal rectal temperature for dairy cows is between 38.2 to 39.1°C according to their living environment (Schutz et al., 2009).

The influence of the hormonal system on cattle can cause the temperature of the vulva to increase during estrus expression. Hormones in the ovarian system, especially estrogen, can make blood vascularization around the genital organs increase, so that the vulva experiences a rise in temperature (Hovinen et al., 2008). This statement is supported by Sakatani et al. (2016) that the measurement of vulvar temperature during estrus expression due to increased temperature is related to hormones secreted during the estrus expression cycle. Vulvar temperatures exhibit a high detection rate of natural estrus and have the potential to excel. This is in accordance with the opinion of Dewi et al. (2011) increased estradiol levels will make the blood supply to the genital tract increase as well; this is what triggers an increase in cell activity in the vaginal area, which in turn causes vaginal temperature to increase.

### Mucus Secretion

The vulva can experience increased mucus or mucosal secretion, so there can be an increase in humidity and visible mucus attached to it. The results showed that when cattle showed estrus expression, there were different levels of mucus secretion. This is listed in Table 7.

The results of the observation of mucus secretion in the vulva of Friesian Holstein crossbreed dairy cows during estrus expression show that cattle that have a medium BCS of 3 and 2.5 show mucus secretion with a frequency score of 3 at most, which is 4 out of 5 heads. Cattle with a low BCS of 2 have mucus secretion with a frequency score of 2 at most, namely 4 out of 5 tails, while cattle with a BCS of 2 have mucus secretion with a score of 1 at most, which is 3 out of 5 tails. According to Irfan et al. (2021)

Table 7. Results of observation of mucus secretion

| Sample | BCS 1.5 | BCS 2 | BCS 2.5 | BCS 3 |
|--------|---------|-------|---------|-------|
| 1      | 2       | 1     | 2       | 3     |
| 2      | 1       | 2     | 3       | 3     |
| 3      | 1       | 2     | 3       | 3     |
| 4      | 2       | 2     | 3       | 3     |
| 5      | 1       | 2     | 3       | 2     |
| Yes    | 7       | 9     | 14      | 14    |
| Ni     | 5       | 5     | 5       | 5     |

Remarks : Si = many occurrences of intensity of estrus expression (score) in the i-th BCS;  
ni = many i-th samples

livestock that have a moderate to obese BCS tend to have more quantity of mucus secretion than cattle that have a low BCS.

Livestock that have a low BCS have little mucus secretion because the livestock is deficient in fulfilling feed, in accordance with the statement of Rukkwamsuk (2011) stated that when livestock experience nutritional deficiencies, what happens is the production of Luteinizing Hormone and Follicle Stimulating Hormone will be inhibited, resulting in a decrease in estrogen hormone production. In addition, the amount and consistency of mucus will change according to the phase of the estrus expression cycle and changes in hormonal levels (Irfan et al., 2017). Livestock that have a moderate Body Condition Score have a lot of mucus secretion. This is because the feed nutrients consumed by livestock are sufficient needs. If cattle are given nutrient-rich forage feed, then livestock will show signs of normal estrus expression, such as mucus discharge on the vulva, this is due to normal estrogen production.

In general, when cattle experience estrus, they will release mucus from the vulva, which is clear and odorless, but if cattle secrete red

mucus, it indicates bleeding in the cervix, while if cattle secrete cloudy milky white mucus, it indicates inflammation of the cervix. Mucus secretion is influenced by estrogen, which results in the secretion of the hormone adrenaline and the hormone oxytocin. The hormone oxytocin makes vascular endothelial cells more permeable, which increases the activity of goblet cells. As a result, water accumulation occurs, which causes high pressure on the goblet cells, causing the goblet cells to rupture and become cervical mucus (Anisa et al., 2017).

### Results of Correlation and Test of Body Condition Score Coefficient of Determination on Estrus Expression Value

The results of the correlation test and the coefficient of determination test attached to annex 2 using the SPSS program show that BCS correlates with the value of estrus expression in livestock. The correlation values and coefficients of determination of each parameter are listed in the following Table 8.

The table above explains that based on the analysis of the correlation test and the coefficient of determination test of all parameters, the BCS has a correlation with each parameter. First, Body condition score with color change has a correlation relationship of 0.70 with a strong relationship level. The two variables also affect each other with a coefficient of determination of 0.498 or 49.8% while the rest of the 50.2% is influenced by other factors. Second, BCS with vulvar swelling has a correlation of 0.91 with a very strong relationship level, the two variables also affect each other with a coefficient of determination of 0.829 or 82.9% while the rest of the 17.1% is influenced by other factors. Third, BCS with increased temperature has a correlation of 0.50 with a moderate level of relationship, the two variables also affect each other with a coefficient of determination of

Table 8. Results of correlation and BCS coefficient of determination test on color change, swelling, temperature increase, and mucus secretion

|                       | Correlation coefficient | R2             |
|-----------------------|-------------------------|----------------|
| Discoloration         | 0.70                    | 0.498 or 49.8% |
| Swelling of the vulva | 0.91                    | 0.829 or 82.9% |
| Temperature increase  | 0.50                    | 0.259 or 25.9% |
| Secretariat           | 0.77                    | 0.593 or 59.3% |

0.259 or 25.9% while the rest of the 74.1% is influenced by other factors. Fourth, the correlation of BCS with mucus secretion that comes out is 0.77 with a strong relationship level. The two variables also affect each other with a coefficient of determination of 0.593 or 59.3% while the rest of the 40.7% is influenced by other factors.

Basically, the BCS has an important influence on the value of estrus expression in livestock. When cattle have a BCS is show good quality heat values such as evenly red vulva color, lots of mucus secretion, swollen vulva, and maximum temperature rise. This is in line with Dapasesi et al. (2020) which states that the ideal BCS for female dairy cattle is 2.5 to 3 on a scale of 1 to 5. Cattle with a low BCS showed poor quality estrus expression, such as almost pale vulvar color, very little or no mucus secretion, swelling, and low temperature increase. Livestock with a BCS below 2 will experience nutritional deficiencies, which can interfere with reproductive system function. Therefore, cattle must have a BCS above 2 for the reproductive system to work properly.

BCS is closely related to the nutrition of feed consumed, feed nutrition can affect hormonal because nutrition plays an important role in the regulation of reproductive hormone production such as Luteinizing Hormone and estrogen, this is in accordance with what Suharto (2013) explained that Nutritional intake of feed that does not meet the needs can cause livestock to have the appearance of less obvious estrus symptoms, because if livestock lacks nutrients it will interfere with the synthesis and regulation of reproductive hormones responsible for the appearance of estrus symptoms. According to Budiawan et al. (2015) when livestock experience nutritional deficiencies in the form of protein, energy, minerals, and vitamins will increase the chances of causing livestock to experience silent heat.

Protein deficiency can cause weak estrus expression, quiet estrus expression, anestrus, and repeated mating. So as to maintain balanced hormone production, providing good feed nutrition and meeting the needs needed for livestock. In addition, the provision of adequate feed nutrition also has an impact on the overall health and reproduction of livestock. Nutritional

improvement can be done by providing quality forage such as a green mixture consisting of elephant grass and field grass, gamal with kaliandra, concentrates, minerals, calcium, selenium, and vitamin E, especially during the postpartus period make sure livestock have enough water to drink (*ad libitum*) (Nurhaliza et al., 2023). In addition, other hormones that play a role in reproductive performance are the production of progesterone that is sufficient to maintain pregnancy, all of these hormones must work in sync with each other to produce a normal reproductive process.

## CONCLUSION

Based on the observations that have been made, it can be concluded that there is a correlation between different body condition scores (BCS) and the value of oestrus expression in the appearance of the vulva (vulvar discolouration, swelling, temperature increase, and mucus secretion) in Friesian Holstein dairy cows, with an average strong relationship. Animal Health Officers are expected to provide additional counselling to farmer members to improve maintenance management, particularly concerning feed management, such as improving the quality and quantity of feed, to ensure that the nutritional requirements of livestock are met.

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