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Pregnancy of Simmental-Ongole crossbreed (SimPO) cows inseminated with frozen semen from Simmental and Brahman

Kebuntingan induk sapi Simmental-Peranakan Ongole (SimPO) yang diinseminasi semen beku Simmental dan Brahman

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ABSTRACT

This research aims to determine the pregnancy success of SimPO cows artificially inseminated (AI) with Simmental and Brahman frozen semen. The research was carried out using a survey method, namely in January–April 2023. The research material was 214 SimPO cows inseminated with Simmental and Brahman frozen semen, which was taken using purposive sampling based on complete data on IB implementers. The research parameters were the body condition score (BCS) of the SimPO cows and the intensity of cervical erection during AI and pregnancy. Data analysis was carried out descriptively using percentages, histograms, and polygon graphs. The results of the study showed that the cows who had a BCS of 7, 6, and 5 had mostly moderate quality (++) cervical erection scores of 47.22%, 42.42%, and 40.11%, respectively, while the cows who had a BCS of 4 and 3 were mostly of low quality (+) 53.33% and 53.13%, respectively. The pregnancy percentage of SimPO cows inseminated with Brahman frozen semen was highest at BCS 7 (50.00%), while Simmental frozen semen was at BCS 5 (31.86%). This research concludes that the pregnancy rate of SimPO cows inseminated with Brahman frozen semen is higher than Simmental frozen semen.

Kata kunci:
Body Condition Score
Semen beku
Kebuntingan
Sapi SimPO

ABSTRAK

Penelitian ini bertujuan untuk mengetahui keberhasilan kebuntingan induk sapi SimPO yang diinseminasi buatan (IB) dengan semen beku Simmental dan Brahman. Penelitian dilakukan dengan metode survei yaitu pada bulan Januari-April 2023. Materi penelitian adalah 214 ekor Induk SimPO yang di IB semen beku Simmental dan Brahman yang diambil secara purposive sampling dengan dasar data lengkap tentang pelaksana IB. Parameter penelitian ialah Body Condition Score (BCS) induk SimPO, intensitas berahi ereksi serviks pada saat di IB, dan kebuntingan. Analisis data dianalisis secara deskriptif dengan persentase, grafik histogram dan poligon. Hasil penelitian menunjukkan induk yang mempunyai BCS 7, 6, dan 5 skor ereksi serviknya kebanyakan berkualitas sedang (++), masing masing 47,22%, 42,42%, dan 40,11% sedangkan induk yang mempunyai BCS 4 dan 3 kebanyakan berkualitas rendah (+) masing-masing 53,33% dan 53,13%. Persentase kebuntingan induk sapi SimPO yang diinseminasi semem beku Brahman tertinggi pada BCS 7 (50,00%) sedangkan semen beku Simmental pada BCS 5 (31,86%). Kesimpulan penelitian ini adalah kebuntingan induk SimPO yang di IB dengan semen beku brahman lebih tinggi daripada kebuntingan induk SimPO yang di IB semen beku Simmental.

INTRODUCTION

Beef cattle are one of the resources for producing food in the form of meat. Many people keep beef cattle because they have high economic value. The widely developed beef cattle breeds in Indonesia, such as Brahman, Ongole, and Ongole Grade (OG), are the descendants of

tropical Bos indicus cattle. In an effort to increase the productivity of beef cattle by improving genetic quality, namely by increasing cattle reproduction using technological interventions such as artificial insemination (Thundathil et al., 2016). Researchers have applied artificial insemination (AI) as a reproductive technology not only to boost productivity but also to achieve rapid genetic gains (Mwanga et al., 2019). The government brought Bos taurus cattle, which are sub-tropical cattle such as Simmental and Limousin cattle, to improve productivity with local beef cattle in Indonesia using a cross-breeding method using AI technology. A special tool known as an insemination gun inserts sperm into a cow's reproductive organs during estrus through artificial insemination. Small breeders can also access artificial insemination technology at a relatively affordable cost, which can result in healthier offspring (Rathod et al., 2017). Simmental, Limousin, Ongole Grade, and Brahman frozen semen are often the choice of breeders, especially breeders in Central Java Province, therefore, breeders must decide to choose only one type of frozen semen that is suitable for their cows (Agustine et al., 2019).

There are 10,158 cattle breeders in the Batang Regency area with a cattle population of 23,124, many of whom keep SimPO females reaching 64.11%, namely 14,826 cattle (Dinas Kelautan Perikanan dan Peternakan Kabupaten Batang, 2021). SimPO cattle result from a cross between male Simmental cattle and parent OG cattle. In the process of producing SimPO cattle, the breeder asks the inseminator to carry out AI with frozen Simmental semen to obtain SimPO calves that have a higher selling price. Breeders also favor SimPO cattle because their offspring grow faster and are larger than other local cattle (Sutarno and Setyawan, 2016).

According to breeders, SimPO cows have the weakness of being difficult to become pregnant as their Simmental genetic content increases. Based on preliminary research in Wanar Village, Tersono Subdistrict, the pregnancy of SimPO cows in AI with frozen Simmental semen during 2021 was only 57%, or 29 out of 51, while those in AI with frozen Brahman semen in Tersono Subdistrict were 69%, or 34 out of 49. Based on the success of SimPO cows AI, which is AI with Simmental and Brahman frozen semen, further research is needed so that it can be used as a stronger basis for increasing the success of cows AI in general, especially SimPO cows in Batang District.

MATERIALS AND METHODS

Methodology

The research was carried out using a secondary data survey method from inseminator report records on 214 SimPO cows in Batang District. Secondary data shows that there are two groups of SimPO cows, each of which is Simmental and Brahman frozen semen AI. The material was determined using purposive sampling, based on the SimPO cows having the complete data required for the research. The survey was conducted for 4 months, namely from January 2023 to April 2023, based on data from the first AI implementation report from January 1, 2021, to November 30, 2021, and the repeat AI was carried out until February 28, 2022. The material for each AI group was differentiated based on the Body Condition Score, or BCS.

Artificial insemination is carried out by a certified inseminator whose AI implementation follows AI standard operating procedures (SOP). Frozen semen comes from the Singosari Artificial Insemination Center, the Lembang Artificial Insemination Center, and the Ungaran Artificial Insemination Center.

The research parameters are BCS, cervical erection intensity during AI, and pregnancy. Secondary variables or data from each material used as research parameters, specifically:

1. The date of estrus and the date of each AI-conducted research material
2. BCS score for each research material using the 1–9 score method according to Parish and Rhinehart (2016), which is the standard for assessing inseminators in Batang District with the following description:

BCS 1 : No palpable fat is detectable on the spinous processes, transverse processes, ribs, or hooks. The tailhead and ribs appear very prominent.

BCS 2 : The animal is still slightly emaciated, but the tailhead and ribs are less prominent. Individual spinous processes are still sharp to the touch. Some tissue cover is present over the ribs toward the top of the back.

BCS 3 : Individual ribs, including foreribs, are easily identified but are not quite as sharp to the touch. Some fat can be felt along the spine and over the tailhead. Some tissue cover is present over the ribs toward the top of the back.

BCS 4 : Individual ribs may not be visually obvious. When palpated, individual spinous processes feel rounded rather than sharp. Some fat cover is present over the ribs, transverse processes, and hooks.

BCS 5 : The overall appearance is generally good. The fat cover over the ribs feels spongy. A palpable fat cover is present on either side of the tailhead.

BCS 6 : A high degree of palpable fat exists over the ribs and around the tailhead. To feel the spinous processes, one must apply firm pressure.

BCS 7 : Considerable fat cover is present with a fleshy overall appearance. The fat cover over the ribs and around the tailhead is very spongy. Fat "pones" or "rounds" may be starting to form along the tailhead.

BCS 8 : The animal is very fleshy and appears over conditioned. Palpation of the spinous processes is near impossible. Large fat deposits are present over the ribs and around the tailhead. Fat ponies around the tailhead are obvious.

BCS 9 : The overall appearance is blocky, with an extremely wasty and patchy fat cover. The tailhead and hooks are buried in fatty tissue, with fat ponies protruding. The bone structure is no longer visible and barely palpable. Large fatty deposits may even impair animal mobility.

3. The intensity of the cervical erectile estrus in each research material is determined by giving a score, namely + = soft, ++ = slighly hard, and +++ = hard (Rohmah et al., 2017).
4. Report records of whether or not a calf was born most recently on December 31, 2022. This birth serves as the foundation for the claim that AI became pregnant.

Data analysis

The research data were analyzed descriptively based on the percentage of pregnancy, histograms, and polygon graphs from the results of AI at each BCS and the intensity of cervical erectile estrus.

RESULTS AND DISCUSSION

Body Condition Score SimPO Cows

The classification of the percentage of the BCS group with scores ranging from 3 to 7 using histograms and polygons is presented in Chart 1.

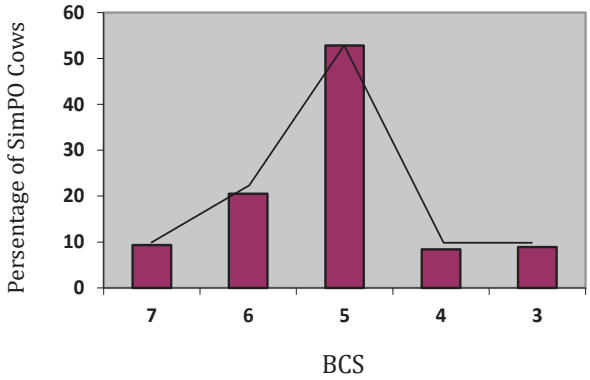

Chart 1. Histogram and polygon graph of percentage of SimPO cows in each BCS

The BCS classification in Chart 1 shows the percentage of SimPO cows in the BCS group, the histogram and polygon graphs depict a normal statistical curve. The highest percentage of BCS score 5 (52.80%) is in the middle, which is flanked by the left side of the BCS score 6 (20.56%) and score 7 (9.35%), on the right is the score 4 (8.41%), and a score of 3 (8.88%) represents a good sample of SimPO cows.

SimPO cattle are the result of a cross between male Simmental cattle and female Ongole Grade, so their bodies show performance towards beef cattle. According to Eversole et al. (2009), BCS is a very good indicator of nutritional status in beef cattle. Eversole et al. (2009) further explained that beef cattle in ideal conditions (BCS 5-7) exhibit a good overall appearance. Parish and Rhinehart (2016) stated that the BCS of beef cows in breeding operations should be in the range of 5 to 7 from the start of the calving season through the breeding season. This helps ensure adequate body conditions for optimum reproductive performance.

Table 1. Number and percentage of SimPO cows in estrus

BCS		7	6	5	4	3	Total
Head		20	44	113	18	19	214
Estrus	(n)	36	66	177	30	32	341
	n/ head	1.8	1.5	1.57	1.67	1.68	8.22
	(%)	21.91	18.25	19.06	20.28	20.5	100

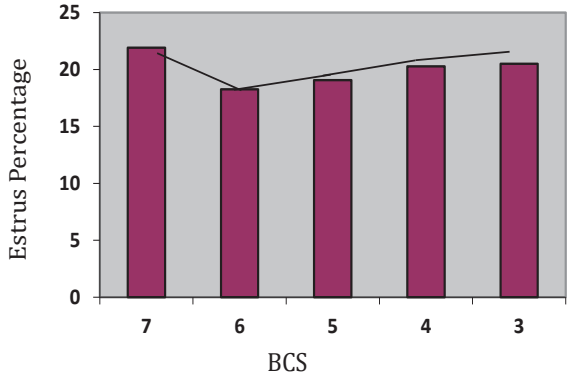

Chart 2. Histogram and polygon graphs percentage of estrus in each BCS

Estrus of SimPO Cows

The results of research on SimPO cow estrus data are presented in Table 1, and the histogram and polygon graphs of estrus cows for each BCS are depicted in Chart 2.

Chart 2 shows that the histogram and polygon graph of the percentage of the highest number of estrus of SimPO cows is BCS score 7 (21.91%) at the edge, then falls at BCS score 6 (18.25%), and then rises slowly at BCS 5 (19.06%), BCS 4 (20.28%), and BCS 3 (20.50%). The difference between the percentage of the highest number of estrus (BCS 7) and the lowest number of estrus (BCS 6) of only 3.66% is a figure of the number of estrus of SimPO cows, which is almost the same between BCS score 3 and BCS score 7. This is normal because a BCS score of 3 to 7 is a BCS that is fit to carry out reproductive activities. According to Sutiyono et al. (2017), BCS with a mode and median score of 2 is the BCS of cows that are unfit to carry out reproductive activities, even though the cow has normal reproductive organs. Sutiyono (2021) states that the signs of estrus that appear are not always visible, depending on the intensity of the estrus. It was further explained that the intensity of estrus is influenced by the level of estrogen produced by the cows in question. The higher the intensity of estrus, the more visible signs of estrus, and the clearer the appearance.

Cervical Erection

Chart 3 shows the histogram graph of the percentage of estrus cows based on the cervical erection score for each BCS.

Chart 3 shows the composition. In BCS 7, 6, and 5, the highest cervical erection score is moderate (++), while in BCS 4 and 3, the highest cervical erection score is poor (+). Based on the composition of estrus performance from the best to the worst, it is BCS 6, 5, 7, 4, and 3, each 27.27%; 24.86%; 16.67%; 10.00%, and 6.25%. This indicates that SimPO cows with BCS scores 5, 6, and 7 have adequate nutrition, so their cervical erection is better than BCS 4 and 3.

The lowest percentage of SimPO cows in estrus, which was characterized by soft cervical erection, was BCS 3 (53.33%) and 4 (53.13%). These results showed that a low BCS indicated that the cattle lacked nutrition. Cows that lack nutrition result in the production of hormones for follicle formation being hampered and affecting the emergence of estrus. Lack of nutrition will result in a decrease in the function of the glands in the body, one of which is the anterior pituitary, resulting in a decrease in the secretion of gonadotropin hormones, namely FSH and LH, so that BCS can be used to predict nutritional deficiencies or adequacy that affect the reproductive process.

Gustiani et al. (2022) stated that feeding livestock with insufficient nutrition can affect BCS. SimPO cows that have low BCS can affect the reproductive system, making it difficult for livestock to become pregnant. The work of these reproductive organs causes variations in the appearance of the reproductive process of each SimPO cow. Breeders in Batang District traditionally feed their cows only grass without any concentrate, but the type of grass they use varies, ranging from superior grass to field grass or rice straw. Breeders' sole use of field grass or straw as feed contributes to the absence of estrus in cows, despite their normal reproductive organs

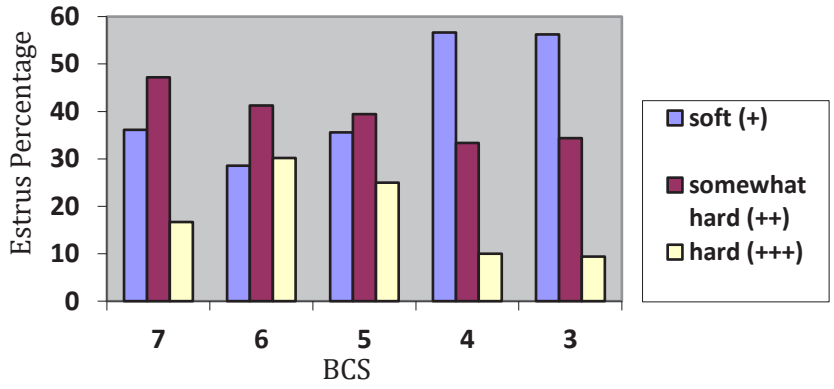

Chart 3. Histogram graph of estrus percentage based on cervical erection score for each BCS

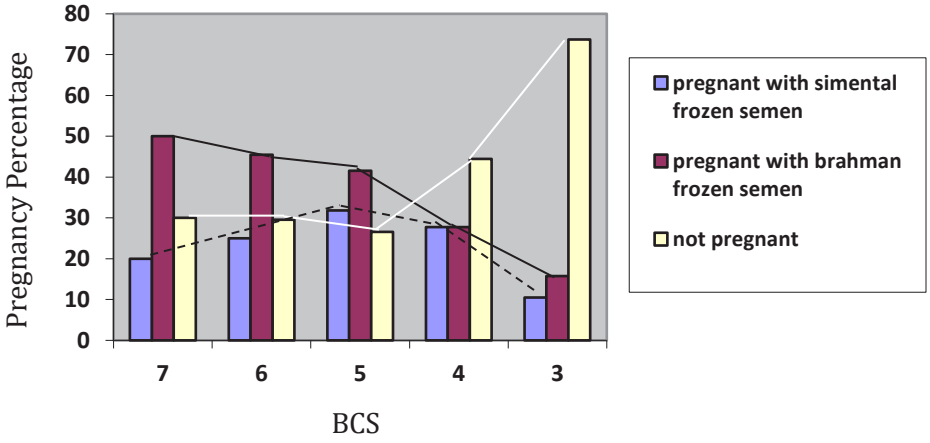

Chart 4. Histogram and polygon graphs of pregnancy percentage for each BCS inseminated with Simmental and Brahman frozen semen

and active ovaries (Sutiyono, 2017).

Eversole et al. (2009) stated that thin cows with BCS 1-4 are reproductively inefficient, susceptible to estrus cycle failure, failure to become pregnant, increased calving intervals, and require additional days to enter the estrus period. It was further explained that to maintain and feed beef cattle to achieve BCS in the optimal medium range (BCS 5-7), which allows beef cattle to achieve maximum reproductive performance. Cows have good body performance, have a BCS of around 5–6. The cow's performance shows that the rearing process is good and its nutritional needs are met. Cows that have this body condition during the reproductive period are likely to be able to give birth every year, and the reproductive process will not be disturbed (Sutiyono, 2022). Body Condition Scores reflect the amount of metabolic energy stored in subcutaneous fat and muscle in beef cows. Optimizing the nutritional intake during pre- and postpartum periods, adding supplemental diets, and reducing periparturition problems are expected to enhance beef cows' reproduction performance (Salman et al., 2021).

Pregnancy Results

Chart 4 presents the histogram and polygon graphs of the percentage of pregnancy for each BCS inseminated with frozen semen from Simmental and Brahman.

Chart 4 shows that the percentage of pregnant SimPO cows in each BCS inseminated with Brahman frozen semen is always higher than that inseminated with Simmental frozen semen, except in BCS 4, where the number and percentage are the same. The low pregnancy yield of SimPO cows that were AI with Simmental semen was due to the decrease in motility after thawing frozen semen. Simmental was higher than Brahman, and the Brahman breed also had a relatively higher volume, percentage of motility, and concentration than Simmental. According to Kumar et al. (2014), motility is an important aspect for assessing the fertility of spermatozoa after freezing and thawing to carry sperm through the female reproductive tract to reach the fertilization site. Sperm motility

depends on adenosine triphosphate (ATP), resulting from the oxidative phosphorylation process in the mitochondrial membrane, which is transferred to microtubules for motility. Different breeds show varying percentages of motility due to differences. These differences affect the composition of energy sources in semen plasma (Rahmawati et al., 2015). Sukirman et al. (2020) stated that motility is influenced by the nation as a semen producer, the percentage decrease in frozen semen motility after thawing from highest to lowest is Simmental, Ongole Grade, Limosin, and Brahman. The Brahman cattle breed has relatively higher volume, motility percentage, and concentration compared to other cattle breeds (Rahmawati et al., 2015). Brahman males have the largest scrotum circumference, producing the highest total spermatozoa and total motile spermatozoa compared to other breeds (Susilawati et al., 2020).

Judging from the polygon curve, the pregnancy percentage of SimPO cows inseminated with Brahman frozen semen was highest at BCS 7, then decreased at the next BCS, and lowest at BCS 3. Body Condition Scores 3 and 4 are not reproductively efficient, so pregnancy is low, while BCS 5, 6, and 7 are the optimum BCS range with maximum reproductive performance, so pregnancy will be higher (Eversole, 2009). Endocrine disorders that cause low estrogen production to the point of being unable to show signs of estrus will result in quiet estrus; improving reproductive performance can be increased by improving nutrition in feed (Sutiyono et al., 2017).

In SimPO cows inseminated with Simmental frozen semen, the percentage of pregnancy in the histogram and polygon graphs follows a normal statistical curve, with the highest at BCS 5, then increasing and decreasing BCS results in a decreasing percentage of pregnancy. The highest pregnancy was in SimPO BCS 5 cows because a score of 5 included the optimum BCS range with the maximum reproductive performance of the cows (Parish and Rhinehart, 2016). The low pregnancy percentage in BCS 7 is thought to be due to fat accumulation in the reproductive organs, so estrogen hormone production is less than optimal. Prasita et al. (2015) stated that BCS that is too high indicates that the fat in the cows is high, so the reproductive organs also have fat deposits, which cause the livestock's hormonal cycle to be disrupted. The lowest pregnancy at BCS 3 indicates that the cow is deprived of feed. The main problem that often causes reproductive disorders on people's farms in rural areas is the feed factor provided (Sutiyono, 2021). It was further explained that beef cattle farming by small breeders, whose traditional farming is very prone to disruption of the reproductive process, results in low pregnancy success. Factors that cause reproductive disorders include the low quality and quantity of feed provided. Cows that have good reproductive abilities if they receive low-quality and quantity feed will have their body condition score (BCS) decrease.

The highest incidence of non-pregnancy was in BCS 3, then decreased in BCS 4 and BCS 5, then rose slowly in BCS 6 and BCS 7. The incidence of non-pregnancy was related to the quality of the estrus of SimPO cows; the worse the quality of the estrus, the higher the incidence of non-pregnancy. Estrus intensity is the quality of estrus displayed by SimPO cows, and the estrus intensity of cervical erection is one of the markers of estrus quality. The softer the cervix, the worse the quality of estrus is, and the percentage of non-pregnancy is also higher. Body Condition Scores 3 and 4 have poor estrus quality because the highest cervical erection score is classified as poor (+), resulting in a high incidence of non-pregnancy. Weak intensity of estrus due to disturbed hormonal patterns, especially estrogen. Endocrine disorders that cause low estrogen production to the point of being unable to show signs of estrus will result in silent estrus (Sutiyono et al., 2017). The presence of the hormone estrogen plays a role in the appearance of estrus symptoms, when the amount of estrogen increases, it will provide positive feedback that affects the nervous system, causing the appearance of estrus symptoms (Ondho and Samsudewa, 2023). Body Condition Scores 5, 6, and 7 have a low incidence of non-pregnancy because the quality of the estrus is better because the highest cervical erection score is in the medium classification (++). The pregnancy percentage of SimPO cows is influenced by many factors, including the quality of estrus which is directly influenced by hormonal conditions. Ondho and Samsudewa (2023) assert that the reproductive process hinges on the hormonal system's mechanism, specifically the interplay between hormones secreted by the hypothalamus, pituitary, placenta, and ovaries. If the system mechanism runs normally, the cow's

pregnancy percentage will be higher.

CONCLUSIONS

Based on the research results, it can be concluded that the pregnancy rate of SimPO cows inseminated with Brahman frozen semen is higher than the pregnancy rate of SimPO cows inseminated with Simmental frozen semen. In an effort to obtain crosses with Simmental frozen semen, it is best to only use SimPO cows that have BCS 4 and 5.

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