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The relationship between hormone and blood mineral connection with the success of artificial insemination in Bali cow on the low and medium areas Jambi Province

Fachroerrozi Hoesni*, and Firmansyah

Faculty of Animal Science, University of Jambi, Kampus Pinang Masak Jl. Raya Jambi - Muara Bulian KM.15, Mendalo, Jambi, Indonesia.
*Corresponding Author: rozi.hoesni@gmail.com.

Abstract. The purpose of this study was to analyze the relationship between the content of the hormone progesterone and minerals in the blood with the success of artificial insemination in Bali cattle in the medium and lowlands of Jambi Province. The research method used in this study is survey and laboratory. The survey method is used to evaluate the success of AI in the form of service per conception (S/C). The sampling technique used in this research is Stratified Random Sampling which consists of 2 strata, namely: Strata I is bali cattle that are inseminated by inseminators in the medium areas of Jambi Province represented by Tebo District. Stara II is a bali cattle that is inseminated by inseminators in the lowand areas of Jambi Province represented by Tanjung Jabung Barat District. Laboratory research was conducted to measure the blood and mineral blood hormones of Balinese cattle, to measure the content of the hormone progesterone in the blood of Balinese cattle using radioimmunoassay (RIA) technique. The results of the correlation analysis (Pearson Correlation, Kendall's tau_b, and Spearman's rho) obtained a relationship between the content of the hormone progesterone in the blood of cattle with the success of artificial insemination in cattle is very significant. The results of the correlation analysis (Pearson Correlation) obtained from the relationship between blood mineral content in the form of Zn, Se and Mg with the success of IB in cattle in the central cattle area of Jambi Province is very significant.
Keywords – artificial insemination, hormones, minerals, Bali cows.

1. Introduction

The success of IB in cattle is influenced by many factors, including the hormone content and mineral content in the blood of cattle. Progesterone is a hormone that is very important to maintain pregnancy. Progesterone is produced by the corpus luteum. The corpus luteum is formed after the follicle secures the egg, so that in superovulated treated cows it produces more corpus luteum and the progesterone hormone. According to [6] the hormone progesterone is often called pregnancy hormone, because its function is to maintain pregnancy.

In ruminant livestock, according to [17] the adequacy of macro and micro minerals is important to note given that these minerals are absolute and must be in feed so that the health and productivity of livestock are not disturbed. This mineral need increases especially during growth and reproductive development. Mineral elements are very important in the physiological processes of livestock. Elements of macro essential minerals such as Ca, Mg, Na, K, and P are needed to structure the body such as bones and teeth, while micro elements such as Fe, Cu, Zn, Mo, and J function for the activity of enzyme and homonal systems in the body.

This study has the purpose of 1) to analyze the relationship of the content of the hormone progesterone in the blood to the success of artificial insemination in Bali cattle in the medium and lowlands of Jambi Province, and 2) to analyze the relationship of minerals in the blood to the success of artificial insemination in Bali cattle in the region medium and lowlands of Jambi Province.

2. Materials and methods

The research method used in this study is survey and laboratory. The survey method is used to evaluate the success of AI in the form of service per conception (S/C), namely how many times insemination occurs until pregnancy occurs in bali cattle in the medium and lowland areas of Jambi Province.

The sampling technique used in this research is Stratified Random Sampling [7] which consists of 2 (two) strata, namely: Strata I is a Bali cattle breed inseminated by inseminators in the medium land region of Jambi Province represented by Tebo District. Stara II is a bali cattle that is inseminated by inseminators in the lowland areas of Jambi Province represented by Tanjung Jabung Barat District.

To measure the content of the hormone progesterone in the blood of bali cattle using radioimmunoassay (RIA) technique. The RIA technique is one of the most sensitive detection methods, which is based on antigen-antibody interactions. Radioactive labeled antigen (hormone) can be used to detect hormone content in a sample. Furthermore, to analyze the relationship of blood hormone and mineral content with the success of artificial insemination in Bali cattle in the medium and lowland areas of Jambi Province, Pearson Correlation, Kendall's tau_b, and Spearman's rho correlations were used.

3. Results and discussions

3.1. The success rate of Artificial Insemination (AI)

The results of the study in the field obtained data that the success rate of IB in Bali cattle in Jambi Province as reflected by service per conception (S/C) was an average of 1.52 ± 0.32. According to [8], the normal S/C values are in the range 1.6 - 2.1 and according to [4], the ideal S/C values range between 1.6 and 2.0. The lower the S / C value, the more fertile the cow, whereas the high S/C value indicates the low level of fertility of the cow. [3] provides guidance in evaluating the success of the implementation of artificial insemination (AI) by providing a standard value of service per conception (S/C) is 1.6. For each region in Jambi Province, there was a variation in the success rate of AI as presented in the following table.

Table 1. Success rate of AI in cattle in Jambi Province.

No.	Jambi Province Region	Service per Conception (S/C)
1.	Medium Areas (Tebo District)	$1{,}34 \pm 0{,}17^{b}$
2.	Low Areas (Tanjung Jabung Barat District)	$1{,}47 \pm 0{,}16^{c}$
	Jambi Province	**$1{,}52 \pm 0{,}32$**

Description: The mean ± SD in one column followed by different lowercase letters shows the difference.

Then in the analysis of the mean difference test for the success rate of AI in cattle between the medium areas (Tebo District) and the low areas (Tanjung Jabung Barat Distric) there was a significant value = 0.00 <α 0.05, which means there are differences. This value means that the success rate of AI in cattle in the medium areas (Tebo District) is better than the low areas (Tanjung Jabung Barat Distric). [13] conducted research in the highlands and lowlands in West Sumatra with the conclusion that the reproductive efficiency of cattle in IB both service per conception (S/C) and conception rate (RC) in the lowlands is better than S/C and CR in the highlands.

The results of [15] conclude that the results of AI in coastal and mountainous areas are relatively the same, which is 37.5% in coastal areas and 40% in mountainous regions. According to [2] [14], differences in the success of AI in mountainous regions with beaches are thought to be due to differences in altitude which will have a lot of influence on diet, quality of vegetation, wind speed

which ultimately stresses the level of livestock which will result in a difference in productivity. The influence of environmental factors on the reproductive appearance of livestock.

Likewise with the results of [12], young cattle that are raised in high topographic areas experience faster puberty compared to young cows that are kept in low topography. The rate of growth of reproductive cells and body cells of cattle for adult sex has the highest value for high topographic regions compared to the medium and low topography.

3.2. Relationship of the progesterone hormone with the success of AI cattle

Progesterone is a hormone that is very important to maintain pregnancy. Progesterone is produced by the corpus luteum. The corpus luteum is formed after the follicle secures the egg, so that in superovulated treated cows it produces more corpus luteum and the progesterone hormone. According to [18], the concentration of the hormone progesterone < 1 nmol/l indicates that there is no reproductive activity in the ovary; between 1-3 nmol/l indicates activity but is doubtful; and concentrations > 3 nmol/l indicate activity in the ovary.

Progesterone is a very important hormone in regulating the normal cycle function of female animal reproduction [5]. In the estrus cycle, namely in the luteal phase, the hormone progesterone inhibits the secretion of the gonadotropin hormone, folicle stimulating hormone (FSH) and luteinizing hormone (LH) in the anterior pituitary gland. These obstacles cause follicles in the ovary to not develop and the hormone estrogen is not produced, so that animals do not show symptoms of estrus [9] [6]. The results of the study found that the progesterone content of cattle in Jambi Province averaged 5.55 ± 1.97 ng/mL, for each region in Jambi Province as presented in the following table.

Table 2. Content of progesterone cattle in Jambi Province.

No.	Jambi Province Region	Cattle Progesterone Hormone Content (ng/mL)
1.	Medium Areas (Tebo District)	5,77 ± 1,86
2.	Low Areas (Tanjung Jabung Barat District)	5,49 ± 2,54
	Jambi Province	**5,55 ± 1,97**

Description: The mean ± SD in one column followed by different lowercase letters shows the difference.

The results of [11] mean that progesterone levels when pregnant Bali cattle or after AI are 15.43 ± 0.50 ng /mL; 17.16 ± 0.34 ng /mL; and 20.78 ± 0.59 ng /mL, for gestational age 30 days, 60 days and 90 days, respectively. Progesterone levels in pregnant Bali cattle increased in line with gestational age, ie from gestational age 30 to 90 days, and statistically it appeared to significantly increase (P <0.05) between gestational age 30th, 60th day and 90th day. According to [6] the hormone progesterone is often referred to as pregnancy hormone, because its function is to maintain pregnancy. In cattle the main source of pregnancy progesterone is the corpus luteum so that the cow including the very dependent corpus luteum or the presence of the corpus luteum as a source of progesterone during pregnancy is very necessary

The results of correlation analysis (Pearson Correlation, Kendall's tau_b, and Spearman's rho) obtained the output that is the relationship between the content of the hormone progesterone in the blood of cattle with the success of artificial insemination in cattle in Jambi Province was very significant at the level of α = 0.01. Correlation coefficient (r) between the content of the hormone progesterone in the blood of cattle and the success of artificial insemination in cattle in Jambi Province differed slightly between the three correlation models.

Based on the correlation coefficient, there is a relationship between the content of the hormone progesterone in the blood of cattle and the success of AI in cattle in Jambi Province. These results indicate the higher the content of the hormone progesterone in the blood of cattle, the higher the success of AI in cattle in Jambi Province, or in other words the better the factor of livestock, the higher the success of AI. Physiologically, the hormone progesterone functions to maintain pregnancy in all

species by stimulating uterine growth and suppressing myometrial contractions [1]. Progesterone is widely used to monitor postpartum ovarian activity, diagnosing early pregnancy in cattle [10].

The results of this study are in line with the research of [16] who found that the percentage of cattle pregnancy is influenced by many things including the estrus quality of AI acceptors which are directly affected by hormonal conditions. There is a positive correlation between the quality of estrus and the percentage of pregnancy, which is the better the estrus state, the greater the percentage of pregnancy. The reproductive process is related to the mechanism of the hormonal system, namely the relationship between hypothalamus-pituitary hormones namely gonadotrophin releasing hormone (GnRH), follicle stimulating hormone (FSH) and luteinizing hormone (LH), ovarian hormones (estrogen and progesterone) and uterine hormones (prostaglandins). If the mechanism of the system runs normally, the percentage of cattle pregnancy will be higher.

3.3. Relationship of blood mineral content to the success of cattle AI

In the study, besides also analyzed the relationship of feed mineral content, also analyzed the relationship of blood mineral content of cattle with the success of IB in cattle in Jambi Province. Research in the field to obtain blood mineral content is shown in the table below.

Table 3. Blood mineral content of cattle in Jambi Province.

No	Blood Minerals	Jumlah
1.	Zn	$1,33 \pm 0,19$
2.	Cu	$0,24 \pm 0,13$
3.	Se	$0,61 \pm 0,08$
4.	Mg	$2,97 \pm 0,38$
5.	Ca	$0,01 \pm 0,06$
6.	P	$0,01 \pm 0,02$

Correlation analysis results (Pearson Correlation) obtained output, namely: The relationship between blood mineral content in the form of Zn, Se and Mg with the success of IB in cattle in Jambi Province was very significant at the level of $\alpha = 0.01$. While the relationship between blood mineral content in the form of Cu, Ca and P with the success of IB in cattle in Jambi Province was not significant at the level of $\alpha = 0.01$ and $\alpha = 0.05$.

4. Conclusion

1. The success rate of AI in cattle in the middle areas is better than the low areas in Jambi Province,
2. There is a relationship between the content of the hormone progesterone in the blood of cattle and the success of AI in cattle in Jambi Province.
3. There is a relationship between blood mineral content in the form of Zn, Se and Mg with the success of AI in cattle in Jambi Province.

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