The correlation between blood metabolic and reproductive performance on the Holstein-Friesian crossbred dairy cows

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Abstract. This research was conducted to investigate the correlation between blood metabolic and reproductive performance on the Holstein-Friesian crossbred. Twenty cows on the second to the third lactation were used in this research. The blood was collected through a jugular vein, eight hours after feeding; it was used for investigating serum protein, glucose, and estradiol. The reproduction including service per conception (S/C), postpartum mating (PPM), and calving interval (CI). The data were analyzed using the Pearson Correlation Model. The average of serum protein, glucose, and estradiol concentration were 7.17±0.86 g/dl; 56.14±4.56 mg/dl; and 4.97±0.75 pg/mL respectively. The average of PPM, CI, and S/C were 150.40±69.85 d; 433.60±106.01 d; and 1.6±0.75 t respectively. The results showed that the correlation coefficient of the estradiol on serum protein and serum glucose were 0.309 and 0.329 respectively. The correlation coefficient of serum protein on PPM, S/C, and CI were -0.096; –0.333; -0.134 respectively. While that of serum glucose on PPM, S/C, and CI were -0.109; –0.327; and -0.309 respectively. Serum protein and glucose had a negative correlation on S/C, PPM and CI.

1. Introduction
Reproductive efficiency of the lactating herd is a major component of profitability in dairy farms. Reproduction determines the primiparous cows to become multiparous and leads to increments in milk yield, alters the average milk yield per day of calving, affects the number of replacement animals available and the risk of culling, and influences the rate of genetic progress [1]. Unfortunately, nowadays Indonesian farmers still deal with the low productivity of dairy cow. One of the problems that lead to this problem is reproductive failure [2]. Blood levels of various biochemicals such as serum protein and serum glucose are essential for the normal function of various systems in the reproductive system. Thus, the serum protein and serum glucose profile can be the tool for understanding and help to characterize these reproduction problems. Blood glucose and protein appear to be the key nutrients affecting fertility and cyclicity in farm animals [3]. On the other hand, estradiol plays a role in reproduction and correlated to serum glucose and serum protein [4].

Some recorded parameters for evaluating the reproductive efficiency are postpartum mating (PPM); service per conception (S/C); and calving interval (CI) [5–6]. Service per conception is the number of insemination needed by the female cow to get the conception [7]. Calving interval is the...
lenght of time between the birth of a calf and the birth of a subsequent calf, both from the same cow [8]. Postpartum mating is the amount of time between the birth and the next mating [7]. [9] It emphasizes that nutrition status has a relationship with reproduction. In the current study, we would like to observe the correlation between blood metabolic represented by serum glucose and serum protein and reproduction represented by PPM, S/C, and CI.

2. Materials and methods

2.1. Materials

Twenty healthy cows in luteal phase on the second to the third lactation were used in this research. Reproductive records including date of mating, gestation, and parturition were used for determining PPM; S/C; and CI. Microlab 300 was used for analyzing the concentration of serum protein and serum glucose. Bovine estradiol enzyme-linked immunosorbent assay (ELISA) kits were utilized to analyze estradiol concentration.

2.2. Methods

2.2.1. Blood sampling. Three milliliters of blood were collected from jugular vein eight hours after feeding and transferred to ethylenediaminetetraacetic acid (EDTA tube)-coated tube for estimating the serum protein and serum glucose. The tube was stored in an ice container and transported to the laboratory. The tubes were centrifuged at 3000 rpm for 15 minutes to separate the serum which then stored at -20°C until further analysis.

2.2.2. Chemical analysis. Serum protein and serum glucose were measured using Microlab 300 spectrophotometer. Serum glucose was measured using the glucose oxidase-peroxidase aminoantipyrin (GOD-PAP, Liquid kit) method. Serum protein was estimated using the biuret method (Biuret, Colorimetric kit). Estradiol was measured using enzyme-linked immunosorbent assay (ELISA).

2.2.3. Reproductive performance. Service per conception (S/C) was obtained by counting the number of inseminations to conception. Postpartum mating (PPM) was obtained by measuring the amount of day between the parturition and next insemination. Calving interval (CI) was obtained by measuring the amount of day between the parturition and the next parturition.

2.2.4. Statistical analysis. The data were analyzed using Pearson correlation model to identify the correlation between blood metabolic and reproductive performance. All statistical analysis was performed using the Statistical Program for Social Science (SPSS) version 16.

3. Result and discussion

3.1. The descriptive data of blood metabolic and reproductive performance

Blood metabolic was represented by serum protein and serum glucose. Reproduction performance was represented by PPM; S/C; and CI. The average of serum protein, serum glucose, and estradiol was shown in Table 1 and the reproduction performance was shown in Table 2.

| Parameters       | Number | Concentration |
|------------------|--------|---------------|
| Serum protein    | 20     | 7.17±0.86     |
| Serum glucose    | 20     | 56.14±4.56    |
| Estradiol        | 20     | 4.97±0.75     |
Table 2. Descriptive statistic of PPM (day); S/C (times); and CI (day)

| Parameters | Numbers | Average    |
|------------|---------|------------|
| PPM        | 20      | 150.40±69.85 |
| S/C        | 20      | 1.6±0.75    |
| CI         | 20      | 433.60±106.01 |

Abbreviations: PPM, Postpartum mating; S/C, Service per conception; CI, Calving interval

3.2. Correlation between blood metabolic and reproductive performance

The correlation coefficient of blood metabolic to reproductive performance was summarized in Table 3.

Table 3. Correlation coefficients between blood metabolic and reproductive performance

| Parameters of blood metabolic | Reproductive performance |
|------------------------------|--------------------------|
|                              | PPM (r) | S/C (r) | CI (r) |
| Serum protein                | -0.096  | -0.333  | -0.134 |
| Serum glucose                | -0.109  | -0.327  | -0.309 |

0.001 – 0.200 = Very weak; 0.201 – 0.400 = Weak; 0.401 – 0.600 = Moderate; 0.601 – 0.800 = Strong; 0.801 – 1.000 = Very strong

Abbreviations: PPM, Postpartum mating; S/C, Service per conception; CI, Calving interval

Serum protein and serum glucose had a positive weak correlation with estradiol with value 0.309 and 0.329 respectively. It was same with [4]. Even though serum protein and serum glucose had a weak correlation with estradiol, it could be explained that they correlated with reproductive performance since estradiol was a critical role in reproduction [11]. This study showed that serum protein had a weak negative correlation on S/C, and had a very weak negative correlation on PPM and CI. Serum glucose had a weak negative correlation on S/C and CI and had a very weak negative correlation on PPM.

The current study explains that serum protein and serum glucose have low correlation to all reproductive parameters. It indicates that some other factors played a role to reproductive performance in this study. One of possible factors is the urea nitrogen in blood. [12–13] reported that serum protein had a positive correlation with blood urea nitrogen (BUN) and [14] reported that the concentration of BUN is higher in a cow with low fertility than a cow with normal fertility. In addition, [15–16] said that ammonia and BUN have harmful effects on oocytes or embryos by lowering the uterine pH so it will make the condition of uterine less favorable for embryos survival [15–17]. Another possible factor that alters reproductive performance is malondialdehyde (MDA). Serum glucose has a positive significant correlation with MDA in which MDA itself is one of causative factors of oxidative stress [18]. [19] also reported that MDA had affected fertility. Malondialdehyde is the last product of lipid peroxidation and therefore changes of MDA concentrations can be used as a biomarker of oxidative stress [20].

4. Conclusion

Overall, serum protein and serum glucose had a negative correlation to estradiol.

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