CORRELATION BETWEEN PROGESTERONE HORMONE CONCENTRATION AND NUMBER OF FETUSES OF ETAWA CROSSBRED GOAT IN DIFFERENT GESTATION PERIOD

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ABSTRACT

This study aimed to investigate the correlation between progesterone hormone concentration and number of fetuses as well as the difference in progesterone hormone concentration from different gestation periods in Etawa crossbred (EC). Five EC goats used in this study were injected with 2 mL of 5.5 mg prostaglandin F\(_2\alpha\) (PGF\(_2\alpha\), Capriglandin) intramuscularly, with an interval of 10 days. Goats that showed symptoms of estrus were mated naturally with male goats. Blood samples were taken on the 7\(^{th}\), 14\(^{th}\), 21\(^{st}\), and 75\(^{th}\) days of gestation. Progesterone hormone concentration was determined using enzyme linked immunosorbent assay (ELISA). The number of fetus was determined at 35\(^{th}\) gestational day using ultrasonography (USG). Four out of 5 goats were found to have 1 fetus and 1 goat had 2 fetuses. The progesterone concentration on the 7\(^{th}\), 14\(^{th}\), 21\(^{st}\), and 75\(^{th}\) days of gestation in goats with single fetus were 5.21, 7.78, 11.97, and 18.78 ng/mL, respectively, while in goat with two fetuses were 8.44, 14.53, 16.81, and 22.73 ng/mL, respectively. The correlation (r) between progesterone hormone concentration and number of fetuses on the 7\(^{th}\), 14\(^{th}\), 21\(^{st}\), and 75\(^{th}\) days of gestation were 0.442, 0.854, 0.592, and 0.757, respectively. It is concluded that progesterone concentrations are highly correlated to the number of fetus in each gestation period in EC goats.

Key words: EC goats, ELISA, number of fetuses, progesterone

INTRODUCTION

Gestation is an important way for female mammals to preserve the offspring of a species. Gestation is started from the fusion of spermatozoa and ovum into a new cell called zygote. Gestational period is the span of time extending from fertilization or conception until parturition. The duration of gestation in goats is 148-154 (Hafez, 2000). According to Feradis (2010), the normal duration of gestation among lambs and goats is about 149 days. Goats have some advantageous traits such as fast breeding; they often give birth to more than 1 (2-4) goat and in tropical regions goats could give birth 3 times in 2 years (Sindoerredojo, 1996).

To maintain a normal gestation, hormones are required in an appropriate proportion. The formation of placenta and fetal endocrine glands create a hormonal interaction between the mother and the fetus. The hormones essential to maintain gestation are ovarian progesterone and estrogen, as well as gonadotropin and prolactin secreted by adenohypophysis (Feradis, 2010).

Progesterone is one of the important reproduction-related hormones secreted by cells inside luteal corpus luteum (Hafez, 2000). Progesterone is important to prepare uterine environment for implantation and the increase in its concentration during gestation is important to maintain gestation (Dunlap and Stomphak, 2004). According to Feradis (2010), progesterone is important for blastocyst survival before implantation and to maintain gestation by creating an endometrial environment suitable for embryo survival and growth, and also to slow spontaneous uterine motility and reduce myometrium sensitivity towards oxytocin.

Progesterone concentration is proportionally correlated to the number of corpus luteum formed in...
the ovaries (Tjiptosumirat, 2009). Siregar (2002) reported that among lambs, progesterone concentration correlate to the number of corpus luteum during corpus luteum formation, while during gestation it is correlated to the number of fetus. Chauhan and Waziri (1991) reported that for fetal number estimation, serum progesterone concentration was significantly higher among lambs with 2 and 3 fetuses compared to single fetus with the values of 19.2, 29.9, and 9.2 ng/mL, respectively. Manalu et al. (1996) reported that progesterone hormone concentration during the last two months of gestation among goats with 2 fetuses was higher than goats with single fetus, 11.11 and 5.79 ng/mL, respectively. Therefore, a study is needed to investigate the correlation between progesterone hormone concentration and number of fetuses of Etawa crossbreed (EC) goats in different periods of gestation.

MATERIALS AND METHODS

The samples used in this study were five female EC goats that have met clinical healthy criteria, had a history of gestation, gave birth to 1 and 2 kids from the last gestation and aged 2-4 years old. All female goats were injected twice with 5.5 mg prostaglandin F2α (PGF2α, Capriglandin) intramuscularly, with an interval of 10 days. Estrus observation was done directly and assisted by male goats every day after the second injection. Estrus observation was done three times a day visually and assisted by male goats at 08.00, 12.00, and 16.00 (GMT +7). The symptoms observed were swelling and redness of the vulva, excessive urination, behavioral change, discharge of transparent liquid from vulva, and standing heat. Goats showing estrus symptoms were then mated naturally.

Goat blood samples were taken on the 7th, 14th, 21st, and 75th days of gestation. Blood used for hormonal assay was taken from jugular vein using 5 mL disposable syringe. The blood was then inserted into vacuum container and then placed inside ice thermos. The blood was transported to Reproduction Laboratory and centrifuged for 15 minutes at 2500 rpm for serum collection. The serum was collected using micropipette and inserted into microtube. Progesterone concentration was measured using enzyme-linked immunosorbent assay (ELISA) method.

The number of fetus was determined using ultrasonography (USG) in which the fetus, uterus, and placenta appeared white (hyperechogenic/hyperechoic) or gray (isoechogenic/hypoechoic), while the amnion and uterine lumen appeared as black (hypoechoogenic/anechoic). The number of fetus was determined at the 35th day of gestation age based on the observation of embryonic sac, amniotic fluid, fetus, and fetal heart.

Data Analysis

The correlation between progesterone hormone concentration and the number of goat fetus was analyzed using simple regression and correlation.

RESULT AND DISCUSSION

The image of USG showed that four of the five EC goats had single fetus while 1 EC goat had 2 fetuses. The progesterone hormone concentration of the EC goats is shown in Figure 1.

Figure 1. Progesterone hormone concentration (ng/mL) at different gestation days

Figure 1 showed that progesterone hormone concentration on the 7th, 14th, 21st, and 75th days of gestation in goat with single fetus were 5.21, 7.78, 11.97, and 18.78 ng/mL, respectively, while in goat with 2 fetuses were 8.44, 14.53, 16.81, and 22.73 ng/mL in goat, respectively. Figure 1 also showed that progesterone hormone concentration of EC goats with single fetus was lower compared to those with two fetuses. Budiarsana and Sutama (2001) also reported a similar result, whereby EC goats with single fetus had a lower progesterone hormone concentration compared to EC goats with multiple fetuses.

The average progesterone concentration on the 7th day of gestation in EC goats with 2 fetuses was twofold higher compared to single fetus (5.21 and 5.21 ng/mL, respectively). This is because the progesterone concentration during formation of corpus luteum is correlated to the number of corpus luteum in the ovaries, as reported previously by Tjiptosumirat (2009) and Manalu and Sumaryadi (1995). Moreover, Jarell and Dziuk (1991) observed that after gestation, the number of fetus and the number of corpus luteum significantly influence progesterone level. In goat, Selvaraju et al. (2007) found that the increasing of corpus luteum number from 0, 1, 2, 3, and >3 resulted in the increasing of progesterone concentration from 0.0±0.0, 3.21±0.13, 4.21±0.36, and 5.17±1.15 ng/mL, respectively.

The result of simple regression and correlation analysis showed that the correlation (r) between progesterone hormone concentration and the number of fetus on the 7th, 14th, 21st, and 75th days of gestation were 0.442 (medium correlation), 0.854 (very strong correlation), 0.592 (medium correlation), and 0.757 (strong correlation), respectively (Figure 2). In line with this study, Adriani et al. (2007) reported that the correlation between progesterone and the number of corpus luteum was strong (r = 0.74).
Determinant coefficient (R2) showed that 72.9% of the variation in the number of fetus can be explained by the variation in progesterone hormone concentration while the remainder is influenced by other variables. Based on regression coefficient, the regression equation obtained is \( Y = 0.214 + 0.108X \). The value of 0.108 means that every 1 ng/mL increases in progesterone concentration in EC goats would increase the number of fetus by 0.108. Hence, the higher the progesterone concentration, the higher the number of goat fetus produced.

CONCLUSION

Based on the result, it is concluded that progesterone concentration is highly correlated to the number of fetus in each gestation period in EC goats.

REFERENCES


Syafruddin et al. 2007. Serum progesterone concentration in EC goats during 21 weeks of gestation in this study was 8.5±3.13 for single fetus and 10.7±3.50 for two fetuses. All the above observations indicated that progesterone hormone concentration was correlated with the number of fetus. Similarly, Siregar (2002) also proved that progesterone concentration in mid-gestation is correlated to the number of fetus.