Cortisol Hormones Profiles of Repeat Breeding Local Cattle

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ABSTRACT

This study aimed to determine the profile of the cortisol hormone in repeat breeding of local cattle. Twenty heads of Bali and Madura cows were used in this study. Each breed consisted of 5 with the normal cycle and 5 head repeat breeding. The cows were 3-5 years of age and had been calving at least once with normal cycle oestrus and healthy body condition. Blood sampling was collected in Bali and Madura islands. To compare the differences of cortisol hormone in both Bali and Madura cows, the statistical analyzing using t-test had been conducted. The result showed that the hormone cortisol concentration in both normal and repeated breeding condition in Madura cows (16,39±5,82 vs 18,86±5,32) was lower than Bali (43,18±30,98 vs 81,79±22,90). Conclussion, the level of hormone cortisol in the repeat breeding cattle is higher when compared with the normal cycle of both breed.

Keywords: Cortisol hormone, Bali Cattle. Madura Cattle, Repeat breeding

INTRODUCTION

Local Indonesian cattle have the ability to adapt to tropical environments, but poor maintenance management often leads to low reproductive performance. Reproductive performance is one of the most important factors that determine the profitable livestock farming business. Poor reproductive performance in cattle is a major problem in livestock, especially in small-scale farms (Yusuf, et al., 2015). The efforts to improve cattle reproductive performance include factors related to improvements in ovarian function, estrous detection, and cultivation maintenance.

Pregnancy is the initial parameter of successful artificial insemination and can be determined from the examination for a certain period of time after artificial insemination. If the cattle do not show pregnancy after re-insemination, it is called repeat breeding. Repeat breeding occurs in female cows when they have a normal estrous cycle and are bred more than 2-3 times but no pregnancy after natural or artificial breeding due to early embryonic mortality and impaired fertilization in the reproductive tract (Noakes *et al*., 2009); Gustafsson and Emanuelson, 2002).. Repeat breeding is generally characterized by long calving interval (18-24 months) (Purohit, 2008), low conception rate (<40%), and high service per conception (>3) (Rustamadji et al., 2007). High repeat breeding causes the low efficiency of cattle reproduction and productivity per year (West, 2003), especially when a treatment was given at partus and the cattle were under the poor stable and environmental conditions.

One of the factors influencing cattle fertility is stress. Stress indicates physiological, and behavioral responses of cattle that try to adapt their body conditions, so that their body will secrete hormones in responses to stress. Cortisol is a hormone secreted by adrenal glands and it is from the gluco-corticoid group. It physiologically affects metabolism, nervous system, and reproduction, and chemically makes cattle able to survive under stressful conditions (Greenstein and Wood, 2010), thus increasing the reproductive power of cattle. According to

Stevenson (2001) and Hollenstein *et al.,* (2006) stress increases the blood concentration of cortisol and is able to delay or block LH spikes, affecting estrous expression without altering the pro-estrous concentrations of blood estradiol. The high cortisol production may affect female cows reproductive system, leading to ovum and ovulation development (Shubaga *et al.,* 2010). Therefore, it is necessary to observe cortisol hormone that affect female cows for repeat breeding.

MATERIALS AND METHODS

Materials: The animals tested were Bali and Madura cattle that were 3-5 years old, ever given birth, had normal estrous cycles and healthy body condition. Each group of 10 cattle was divided into two, i.e. group I consisting of five fertilized cows and group II consisting of five cows with repeat breeding.

Collection of blood sample : Blood samples were collected by vacuum through the jugular vein puncture. The blood samples were placed in a vacutainers containing ethylene diamine tetra acid (EDTA) as an anticoagulant and were placed in plastic and transported to the laboratory in an ice box. The laboratory, blood tubes were centrifuged at 2,000 rpm for 20 minutes (Purohit et al., 2013) then the serum was separated and stored at -20 °C for further analysis.

Hormone Analysis : Blood plasma concentration of cortisol hormone was measured by ELISA techniques by using commercial kits (DRG, Germany) (Bayazit, 2009), in the Laboratory of Faculty of Veterinary Medicine, Universitas Gadjah Mada.

Statistical Analysis: the mean values ± SEM for concentration of cortisol hormones were carried out by the use of Student's *t-test* for paired comparisons, (Astuti, 2007).

RESULTS AND DISCUSSION

Based on the results of these study, it can be concluded that Madura cattle shown the lowest level of cortisol hormone, while Bali cattle shown the highest one and the mean corticosteroid hormone level in cattle with repeat breeding was higher than that in fertile cows.

Table 1.Mean cortisol hormone level in both normal cattle and cattle with repeat breeding (RB)

Breed	Normal (mg/dl)	Repeated breeding (mg/dl)	Significant
Madura	16.39±5.82	18.86±5.32	0.503
Bali	43.18±30.98	81.79±22.90	0.06

Based on the statistical results, the level of cortisol hormone in each cow was different, but the difference was not significant ($p>0.05$). Bali cattle had a high level of cortisol hormone (43.18 ± 30.98 vs 81.79 ± 22.90 mg/dl) compared with Madura cattle (16.39 ± 5.82 vs. 18.86 ± 5, 32 mg/dl). According to Yoshida and Nakao (2005), the normal levels of cortisol hormone in cattle ranged from 3.8 to 4.4 ng/ml. The high level of cortisol hormone in Bali cattle was due to a hot temperature of environment and less optimal stable ventilation management because the settings of stable ventilation can control air capacity inside the stable. According to Kaewlamun (2010), stress is associated with high or low temperature that interferes with the normal release of hormones. Heat stress will interfere with reproductive processes of cattle because cortisol will suppress LH pulses and these hormones will affect estrogen and progesterone hormone cycle that function in estrous cycle, so that if

hormonal imbalance occurred in the body, reproduction process was also disturbed (Breen *et al*., 2004). It was supported by Ronchi *et al*. (2001) and Hansen (2001), indicating that heat stress during estrous cycle will inhibit the growth of oocytes by altering the secretion of progesterone, LH, FSH and ovarian dynamics, and the heat stress can inhibit embryonic development and the increase of early embryonic mortality. The decrease of LH affected the decreased growth of follicles that inhibits the formation of puberty onset in young female cows and estrous cycles in post-natal cattle.

The statistical results showed that there was no significant difference between cattle with repeat breeding ($p > 0.05$) and fertile cattle, but mathematically the highest levels of cortisol hormone were found in Bali and Madurese cattle with repeat breeding (81.79 ± 22.90 vs 18.86 ± 5.32 mg/dl) compared with normal one (43.18 ± 30.98 vs 16.39 ± 5, 82 mg / dl). According to Oakley *et al*. (2009), cortisol hormone in cattle with repeat breeding was higher because it inhibited the secretion of GnRH and LH from a hypothalamic-pituitary system, resulting in the inhibited growth of follicles as well as estrogen and progesterone hormones due to lack of Adenosine triphosphate (ATP) that serves to the activate cyclic Adenosine monophosphate (cAMP) as intracellular messenger. Cattle with high stress during an estrous period affected hormones, affecting the secretion of ACTH hormone that could cause the luteinizing hormone (Singh *et al*., 2005). According to Bage (2002) and Smith (2005), the levels of cortisol hormones higher than normal level affect the production of progesterone hormones from the adrenal glands or otherwise the increased levels of cortisol hormones cause the decreased production and performance of progesterone hormones, which can cause early embryonic mortality because the decreased level of progesterone causes the body's inability to keep the fetus.

Other factor that can cause stress in cattle was the nutrient intake of feed. According to Marae *et al.,* (2007), stress can reduce dry matter intake that directly inhibit the secretion of GnRH and LH from hypothalamic-pituitary system. The cause was that the decrease of estradiol secretion in dominant follicles will worsen estrous detection (Fabio and Scaramuzzi, 2003). If such feed and environmental conditions continue, they will affect ovarian hypofunction and it will be converted to an ovarian atrophy. Ovarian atrophy is an ovary smaller than normal one with a slippery surface and no follicle growth, preventing reproduction. Such conditions lead to the declining physiological conditions of cattle with persistent anestrous symptoms and repeat breeding (Ratnawati *et al.,* 2007).

CONCLUSIONS

From the results of the study, it can be concluded that the highest level of cortisol hormone was found in Bali cattle. The cattle with repeat breeding had the higher level of cortisol hormones compared with fertile ones.

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