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The Effect of GnRH on Reproductive Performance Swamp Buffalo in West Sumatera

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Abstract

The administration of hormone GnRH will affect the reproductive organs and can improve the reproductive performance of buffalo. The buffalo in West Sumatra as a producer of dadih has the population is decreasing, in 2014 there was a decline of up to 50 percent. The decrease of the buffalo population is caused by various factors including genetic and environmental factors. The development of buffaloes is relatively slow because the reproduction rate of buffaloes is lower than that of cattle, besides that it is also difficult to detect estrus, the pregnancy period is relatively long (11 months) and longer birth intervals. This study aims to determine the best dose of Gonadotropin-Releasing Hormone (GnRH) in the estrus synchronization process on the swamp buffalo producing of dadih in Indonesia. A completely randomized design was used in this study. Four different doses of GnRH (200, 225, 250 and 275 ml/buffalo) and each treatment was replicated five times. The speed of estrus and estrus length were the measured variables. The results of the study showed that the doses of GnRH significantly ($P<0.05$) increase ofestrus speed and estrus length. It is concluded that the best GnRH doses for estrus synchronization in the swamp buffalo producing of dadih was 2. 25 ml/buffalo with estrus speed 18.2 h and estrus length 18 h.

Keywords: Dadih; estrus response; estrus synchronization; GnRH; swamp buffalo.

Introduction

Swamp buffalo are animals commonly raised for meat throughout SEA Asia. Their ability to adapt to different conditions have allowed them to thrive in many habitats. One advantage of raising buffalo rather than other ruminants is this adaptive ability and superior tolerance to poor feed quality. According to Yendraliza et al (2011) Artificial insemination (AI), which is normal practiced in cattle, is seldom performed in buffalo, because of the weakness of estrus symptoms and the variability of estrus length, which make estrus detection is very difficult. Even though these animals are chiefly raised for their meat rather than as dairy animals, farmers in West Sumatra make a yoghurt-like fermented food from buffalo milk known as dadih which has 43% lower cholesterol and 65% higher calcium than that made from cows. It contains antioxidants (Chalid and Hartiningsih 2013), than have benefits for human health.
The market for dadih is at present limited to West Sumatera but has the potential to be widened especially with the current interest in probiotic foods. Dadih was traditionally only fermented in bamboo but with the development of food processing technology has made its manufacture more efficient. The methods used include using more controlled fermentation process to extend the shelf life. The use of plastic covers rather than leaves is one way that can be used to control the process (Sisriyenni and Zurriyati 2013). Buffalo milk plays a significant role in satisfying the nutritional demands of humans in a number of developing countries (Salam and Shibiny 2011). Buffalo milk has a rich complex nutritional profile. However, in West Sumatera, it is rarely consumed in its raw state. Here, milk from swamp buffalo (Bubalus bubalis) is fermented in a bamboo tube for 48 h to produce Dadih. Dadih production occurs in several different areas throughout West Sumatra. If proven to have

probiotic properties, more extensive use of this local dish could be encouraged to improve the health and nutritional status of people in this area.

There is good reason to believe that West Sumatera buffalo milk might be such a source of probiotics (Shafakatullah and Chandra 2014). Isolated lactic acid bacteria from buffalo milk in Islamabad, namely, *L. acidophilus, Lactobacillus delbrueckii ssp. bulgaricus, Lactococcus lactis ssp. cremoris, L. Lactis ssp. lactis,* and *Streptococcus thermophilus*. Similarly, (Sharma et al 2013) also found *L. lactis* in buffalo milk in India (Tembekar et al 2009), found strains of *Lactobacillus spp*, isolated from buffalo, goat, and cow milk, had potential as probiotics. For dadih production to be expanded the number and reproductive performance of female buffaloes must be improved. At the moment dadih production has stagnated and even begun to decline because of the decreasing number of buffalo. The population of buffalo in West Sumatra in 2016 has decreased from 121.939 to 117.983 (BPS 2018). This decline of buffalo population is due to uncontrolled marital management, difficulty in providing superior males, and maintenance goals are still considered as side jobs. (Triwulanningsih 2007) reports that the reproductive rate of buffalo is lower than that of cows, because of the difficulty in detecting estrus, the relatively long gestation (11 months) and longer intervals between births. When buffalo are regularly milked estrus is delayed further. Environmental management limitations are lack of knowledge and application of reproduction technology. In many parts of Asia, farmers know very little about how to detect estrus (Hastono et al 2013). Problems with livestock systems and farmers' skills and knowledge limitations can be improved through training, counseling and mentoring. If this can be done, the raising of buffalo for dairy could become an easy way to improve the nutritional status of rural communities through the consumption of milk from their own herd. (Wirdahayati 2007) reports that efforts to preserve dadih production in West Sumatra includes improving the maintenance management of lactating females through adequate feed provision and streamlining the reproductive process to ensure milk production is sufficient for calves to thrive and to provide adequate excess milk for dadih production.

Chaikhun et al (2010) stated that the limitations of productive performance in female swamp buffalo include many unique features such as inherent late maturity, prolonged intercalving interval, decreased in ovarian function (especially in summer), poor estrus, and difficulties detecting estrus that cause problems in predicting the time of ovulation for artificial insemination. Buffaloes often experience silent heat meaning that they do not clearly show signs of estrus so that the farmer does not know the right time to mate the buffalo either naturally or with AI with the right time. The condition of silent heat in buffalo makes it difficult for farmers to develop buffalo cattle. This condition was natural and cannot be genetically removed. The condition of silent heat results in the difficulty of farmers in detecting estrus in buffaloes, so that the success of IB implementation is still relatively low and birth intervals.

Reproductive technology that can be applied is synchronizing estrus by utilizing exogenous hormones including GnRH. (Hall et al 2009) GnRH is a natural hormone produced by the hypothalamus in the brain that can produce another hormone called Luteinizing Hormone (LH) in collaboration with Follicle Stimulating Hormone (FSH) in follicular development and the onset of signs of estrus. (Afriani et al 2014) GnRH injection of 48 hours caused more ovulation to occur in response to the release of FSH and LH by hypophysis due to GnRH stimulation. GnRH injection in each estrus cycle will ovulate the dominant follicles that exist and the emergence of new follicular waves 2 or 3 days later (Rabidas et al 2017).

The application of estrus synchronization technology with the use of the GnRH hormone could be expected to improve the reproductive performance of milk-producing buffalo. Along with improvements to the housing system and feed provision and increasing dadih shelf-life this will enable the dadih industry to expand and flourish (Bamualim et al 2007). Based on

that described above, study is conducted to determine the best dose of GnRH in the process of estrus synchronization on buffalo swamp.

Material And Method

Buffalo: Twenty the swamp buffalo producing of dadih were used in this study. The reason for choosing this age range was that the average age at first mating for buffalo has been found to be 2.8 ± 0.3 years (Ibrahim 2008). Buffalo were chosen with purposeful sampling from three breeders using intensive farming methods.

Research materials and tools: The material used is GnRH, PGF2α, FSH, physiological NaCl, NaOH, Ethanol, Methanol. The tool used is petridis 35 and 60 mm, pasteur pipette, disposable syringe, glas cover, gas pack. As well as the main tools used include incubators, electric scales, ovens, ependorf pipettes, refrigators, sentifuge.

Experimental design: A completely randomized study design with 4 treatments and 5 replications. each replication consisted of 5 (five) buffalo as experimental units, namely treatment A. (200 ml/buffalo), B. (225 ml/buffalo), C. (250 ml/buffalo), and D. (275 ml/buffalo). Synchronization was achieved by injecting GnRH on day 0, PGF2α (day 7) then two days later GnRH, after which estrus was detected. The speed of estrus and estrus length were the measured variables.

Statistical analysis: All data were analyzed by analysis of variance (ANOVA) using a general linear model procedure on SPSS software version 16.0. Duncan's multiple range test was used for determination of differences between treatment means (Steel and Torrie 1980).

Results and Discussion

Estrus Speed

Analysis of variance indicated that four doses of GnRH significantly ($P<0.05$) influential on the speed estrus in the swamp buffalo producing of dadih. Table 1 shows that the estrus speed of the swamp buffalo producing of dadih on treatment 225 ml/buffalo produced the fastest estrus; 18.2 hours after the second GnRH injection. This was statistically faster than any other dosage trial. The results showed that GnRH injection can affect estrus speed in the swamp buffalo producing of dadih. GnRH can stimulate FSH, which function in stimulating follicle growth in the ovary. Follicle growth will stimulate the formation of estrogen, which is similar to that obtained by (Rajamahendra et al 2002) that the number of recruited follicles to develop further to de Graaf is highly dependent on FSH concentration in the blood. The appearance of estrus is due to the influence of the increase in the estrogen hormone in the body produced by the ovum (Fricke and Shaver 2007).

Table 1. Average Estrus Speed (Hours) And Length Of Estrus (Hours) In The Swamp Buffalo Producing Of Dadih After Injection Of Gnrh With Different Doses

The Dosages of GnRH (ml/buffalo)	Estrus Speed (h)	Estrus Length (h)
A. 2.00	29.4^{ab}	16^{a}
B. 2.25	18.2^{c}	18^{a}
C. 2.50	32.4^{a}	22^{b}
D. 2.75	28.6^{b}	18.6^{a}

Data presented as the mean of 5 replicates, a-c Values in the same column with different superscript letters are significantly different ($P<0.05$)

GnRH injection in treatment B (225 ml/buffalo) shows that the speed of estrus emergence most quickly when compared to treatments A, C, and D. This is caused by the injection of GnRH at a dose of 225 ml/buffalo there is a lot of follicle formation. This is

similar to that obtained by (Yendraliza et al 2017) that the magnitude of the percentage change in buffalo behavior given GnRH-PGF2α from buffaloes which do not get additional synchronous hormones, probably caused by the number of follicles formed due to the addition of GnRH. Addition of the GnRH will stimulate follicle growth (Ibrahim 2008). GnRH gave on the first day, PGF2α on day 7th and GnRH on the 9th day showed a significant influence between estrus response and pregnancy in Mediterranean swamp buffalo (Neglia et al 2016).
The speed of estrus (onset of estrus) is the time when animals show signs of estrus for the first time. The ultimate goal of estrus seizure in the swamp buffalo producing of dadih is to increase reproduction with the presence of clear estrus signs so that it can improve time efficiency for IB which will ultimately increase production of dadih. The average speed of estrus the swamp buffalo producing of dadih in treatment B (225 ml/buffalo) is 18.2 h. The results of this study similar to that obtained by (Yendraliza et al 2017) synchronization protocol on female buffaloes in Kabupaten Kampar using combinations of GnRH and PGF2α in postpartum period make higher estrus intensity, faster estrus and longer estrus duration, the estrus speed (30.80 hours to 2.5 hours), and estrus length (18.6 hours to 6.5 hours).

Estrus Length

Analysis of variance indicated that four doses of GnRH significantly ($P<0.05$) influential on the estrus length in the swamp buffalo producing of dadih. Table 1 shows that estrus length of the swamp buffalo producing of dadih on treatment 200 ml/buffalo produced the fastest estrus; 16 h after the second GnRH injection, however, it was not significantly different ($P>0.05$) from treatment B (225 ml/buffalo) with estrus length is 18 h. The length of estrus is the time interval between the onset of estrus and the completion of the estrus period. The estrus length also influenced by age, body condition, and the types of hormones used for synchronization or estrus induction (Irmaylin et al 2012).
The results show that injection of GnRH can affect the estrus duration in the swamp buffalo producing of dadih. This is caused by differences in the dose of GnRH injection which can affect the duration estrus of buffalo. The difference in the duration of estrus in female mud buffalo is caused by the difference in the number of doses of GnRH given which will affect the length of work of PGF2α (Irikura et al 2003 and Yendraliza et al 2012). Estrus length is the time shown by buffalo with the first range showing signs of estrus and loss of estrus signs in buffalo. Increasing the dose of GnRH synchronized with PGF2α produced different estrus length (Yendraliza et al 2012).
Genetic improvement can be obtained by improving feed management and reproduction in buffalo, one of one effort that can be done is injecting GnRH, day 1st, followed by PGF2α, 7th day; then GnRH 9th day; and IB, 10th day (Talib et al 2003). Improve genetic quality and increase livestock populations, requires serious handling and attention in buffalo, because of the phenomenon of difficulty detecting heat related to the phenomenon of silent heat (Tambing et al 2000). (Tiesnamurti and Talib 2011) State reproduction improvement is aimed at improving reproductive efficiency through regulating the marriage system and accurate detection of estrus or estrus striking which ends with marriage which results in a maximum number of pregnancies.
In order to improve reproductive efficiency, various synchronization protocols for buffalo have been made to regulate the estrous cycle and ovulation. According to Chaikhun et al (2010) It has been reported that following gonadotropin-releasing hormone (GnRH) associated with PGF 2 administration and timed artificial insemination, the percentage of ovulating buffaloes were 60-90%. The results of the study by Paul and Prakash (2005) and Konrad et al (2013) stated that with conception rates recorded as 32.7%-60% during the breeding season. According to Barile et al (2015) buffaloes were treated with progesterone (P4)-releasing intravaginal device (PRID) along with pregnant mare serum gonadotropin (PMSG) and PGF 2, the ovulation rate during the low breeding season and breeding season

was 58.3% and 91.7%, respectively and pregnancy rate was between 28% and 52.7% during the non-breeding season Based on the research results Neglia et al (2003) and Carvalho et al (2013). Observed a pregnancy rate of 45% in buffalo cows synchronized with PGF2α alone and 48.8% when PGF2α was combined with GnRH injection at the time of AI (Neglia et al 2001). Similarly the pregnancy rate in Murrah buffaloes was 33.3% (Paul and Prakash, 2005), editerranean Italian buffalo 43.7% (De Rensis et al 2005), Italian cyclic buffalo 36.0% (Neglia et al 2003) and Swamp buffalo heifers vs. cows 15.0 vs. 51.4% (Chaikhum et al 2010) after using the Ovsynch protocol and timed insemination, respectively. In the current study, the circulating concentrations of P4 precisely indicated the presence or absence of a CL and reflected its size and activity.

The average of estrus length of the swamp buffalo producing of dadih in treatment B (225 ml/buffalo) is 18 h. According to Baruselli et al (1999) who reported variable length estrus buffaloes was 4 to 64 h. However, (Chao et al 2010) reported that the average duration of estrous was 15.13 ± 3.52 h in dairy cows, while Deka et al (2009) recorded that the average duration of estrous was 36.00 ± 3.89 h in Crestar cows. This difference is again might reflect the differences in the type of breed, environment, nutrition and body condition (Nanda et al 2003). According to Barile (2005) who reported that the average onset of estrous was 54.6 h in buffaloes.

Conclusions

It is concluded that injection of GnRH 225 ml/buffalo is the best dose in the application of estrus synchronization technology in the swamp buffalo producing of dadih, with the speed estrus of 18.2 h and estrus length of 18 h.

Acknowledgments

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