

Effect of Pregnancy Rate Following Timing of Artificial Insemination after Estrus of Hanwoo Female

Jung Seok Yang¹, Young-Tae Heo², Sang Jun Uhm^{1,†} and Dae Hwan Ko^{1,†}

¹Department of Animal Science and Biotechnology, Sangji Youngseo College, Wonju 220-713, Korea

²Department of Animal Sciences, Chungbuk National University, Cheongju 361-763, Korea

ABSTRACT

This study was conducted to investigate optimal time of artificial insemination (AI) to Hanwoo female after natural estrus. AI was occurred 12 and 24 hours after natural estrus in both heifer and multiparous recipient then pregnancy and parturition rates were estimated. Results indicated that AI performed at 24 hours after natural estrus showed significant ($p<0.05$) higher pregnancy rate in both heifer and multiparous recipient groups with significantly ($p<0.05$) higher abortion rate. However, there are no significant differences of parturition rate, twin birth and sex ratio in both heifer and multiparous recipient groups. Therefore, our results may suggest that performance of AI at 24 hours after natural estrus promise higher pregnancy rate than AI at 12 hours after natural estrus in both heifer and multiparous recipient.

(Key words : Pregnancy, Estrus, Timing, AI, Cow)

INTRODUCTION

Artificial insemination (AI) technique is now common and widely used for animal breeding as well as human infertility. In animal breeding program, AI offers various advantages such as improvement of heredity, increase conception rate, early judgment of genetic ability in breeders groups, prevention of reproductive disease, labor saving and research purpose. Therefore, AI make able to possible to parturition of cow for every year results in improving economic value in animal husbandry field. Although AI technique has been developed for more than 5 decades, efficiency of AI is very variable depends on quality of semen, proficiency, age of cow, breeding condition and reproductive disorders (Baek *et al.*, 1998ab; Park *et al.*, 2011). Lee *et al.* (2010) reported that quality of frozen semen is main factor to influence pregnancy rate after AI. Park *et al.* (2013) suggested that selection of semen and proficiency are considerable factors for improving pregnancy rate. It is well studied that genetic abilities such as fat thickness of posterior and parity can affect efficiency of AI result in increase and decrease pregnancy rate.

One of critical factor which decrease pregnancy rate in cow is low level of progesterone in cow. It is well studied that repeat-breeding cows performed low level of progesterone on 7 days after ovulation (Kimura *et al.*, 1987; Shelton *et al.*, 1990). Low level of progesterone induces inhibiting the development of uterus result in frequent early embryonic death. Ayalon *et al.* (1978) reported that repeat-breeding cows showed occurrence of 50% of early embryonic death within 16 days after AI, delayed embryo development and abnormal development. Delayed embryo development caused by incomplete recognition of pregnant, decrease of interferon- τ secretion and regression of luteinizing (Thatcher *et al.*, 1994). Han *et al.* (2005) studied that injection of rbST during AI increase pregnancy and parturition rates. Although numerous studies suggested various indication of increasing the efficiency of AI, appropriate precise time of AI to improve efficiency of pregnancy after of cow was poorly understood. Natural estrus continues for 18~19 hours and ovulation occurs 10~11 hours after termination of estrus (Hafez *et al.*, 1980). However, precise time of estrus is very difficult to recognize by observation. Thus, AI technicians in field generally select 12 or 24 hours after observation of estrus. Therefore, hypothe-

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† Corresponding author : Dae Hwan Ko: Phone: +82-33-730-0787, E-mail: dhko@sy.ac.kr, Sang Jun Uhm: +82-33-730-0828, E-mail: sjuhm@sy.ac.kr

sis of our study is timing of AI may affect pregnancy and parturition rate. We compared pregnancy and parturition rate in heifer and multiparous recipient groups which undertaken AI 12 hours and 24 hours after natural estrus.

MATERIALS AND METHODS

All animal experiments were performed in compliance with the Guide for the Care and Use of Agricultural Animals in Research and Teaching, published by the Federation of Animal Science Societies.

Artificial Insemination and Recipients

KPN frozen semen straws used in this study were provided from NH nonghyup and AI was conducted in Hoengseong, Kangwondo area during April 2011 to March 2012. Recipient was classified with 2 groups as heifer and multiparous recipient. AI was performed 12 hours and 24 hours after natural estrus.

Pregnant Confirmation

Pregnant was confirmed by observation of non-estrus and rectal examination on 2 month after AI.

Statistic Analysis

Data were analyzed using the Statistical Analysis System (SAS Inc., Cary, NC, USA). The general linear model was used to assess differences in pregnant and non-pregnant. Significant differences were determined using Chi-square test. Statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

Pregnancy rates of heifer and multiparous recipient groups were investigated following the timing of AI after natural estrus. Additionally, pregnancy rates of AI conducted 12 and 24 hours after natural estrus in both groups. Table 1 indicated that pregnancy and abortion rates of AI performed 24 hours after estrus (pregnancy rate: 81.8 ± 2.6 vs. $79.5 \pm 5.6\%$, abortion rate: 8.6 ± 1.9 vs. $2.1 \pm 4.2\%$) are significantly higher than those of 12 hours in heifer group ($p < 0.05$). However, there is no significant difference in parturition rate in both 12 and 24 hours groups. In case of multiparous recipient, AI performed 24 hours after estrus group showed significantly higher pregnancy and abortion rates (pregnancy rate: 81.1 ± 3.5 vs. $75.8 \pm 1.6\%$, abortion rate: 7.0 ± 0.2 vs. $2.9 \pm 3.5\%$) than AI performed 12 hours after estrus group ($p < 0.05$). Multiparous recipient case also showed no significant difference in parturition rate in both 12 and 24 hours groups similar with heifer case (Table 2).

Taken together of results, AI performed at 24 hours after natural estrus in both heifer and multiparous recipient groups showed significant higher pregnancy and abortion rates ($p < 0.05$) without no significant difference in parturition rate ($p < 0.05$). Higher abortion rate in AI performed at 24 hours after natural estrus may cause economical disadvantage in farm due to increase of days open in aborted Hanwoo recipient. Increase of abortion may caused by fertilization of sperm and aged oocytes. Previous studies able to explain this phenomena that aged oocyte show higher ROS level and contain more apoptotic cells than normal embryos (Uhm *et al.*, 2011). Therefore similar problem with aged oocytes cause early

Table 1. Pregnancy, abortion and parturition rates following timing of AI into heifer

Timing of AI	No. of recipients	No. (%) of pregnancy	No. (%) of abortion	No. (%) of parturition
12 hr	30	24 (79.5 ± 5.6) ^a	1 (2.1 ± 4.2) ^a	23 (77.4 ± 5.3) ^a
24 hr	65	54 (81.8 ± 2.6) ^b	5 (8.6 ± 1.9) ^b	49 (73.2 ± 4.5) ^a

^{a,b} Within a row, values without a common superscript differed ($p < 0.05$).

Table 2. Pregnancy, abortion and parturition rates following timing of AI into multiparous recipient

Timing of AI	No. of recipients	No. (%) of pregnancy	No. (%) of abortion	No. (%) of parturition
12 hr	91	69 (75.8 ± 1.6) ^a	3 (2.9 ± 3.5) ^a	66 (72.9 ± 3.4) ^a
24 hr	87	72 (81.1 ± 3.5) ^b	6 (7.0 ± 0.2) ^b	66 (74.1 ± 3.7) ^a

^{a,b} Within a row, values without a common superscript differed ($p < 0.05$).

Table 3. Production of offspring following timing of AI into heifer

Timing of AI	No. of parturition	No. (%) of twin	No. (%) of male	No. (%) of female
12 hr	23	1 (2.8±5.6)	8 (35.0±12.9)	16 (65.0±12.9)
24 hr	49	1 (1.2±1.7)	16 (36.5±8.9)	34 (63.5±8.9)

Table 4. Production of offspring following timing of into multiparous recipient

Timing of AI	No. of parturition	No. (%) of twin	No. (%) of male	No. (%) of female
12 hr	66	2 (2.8±5.6)	30 (43.5±11.4)	38 (56.5±11.4)
24 hr	66	1 (0.9±1.3)	29 (41.9±2.7)	38 (58.1±2.7)

embryonic death result in delaying of development and abnormal development of embryos (Ayalon *et al.*, 1978). To solve this problem, several solutions were suggested. Han *et al.* (2005) reported that injection of rbST to Hanwoo recipient can increase pregnancy and parturition rates. Injection of 1,500 IU of hCG during AI is helpful for maintaining pregnancy by increasing level of P4 in blood (Choi *et al.*, 2002).

Additional possibility of affection to pregnancy following AI may skill inseminator. In this study, pregnancy rate of 1st attempt of AI was approximately 80 % in both heifer and multiparous recipient groups. This pregnancy rate in Hanwoo is significantly higher than average pregnancy rate (49.1%) of Kangwondo east area (Park *et al.*, 2013).

Table 3 and 4 indicated that there are no significant differences of twin rate and sex ratio between AI performed in 12 hours and 24 hours after natural estrus. Our result suggest that AI performing 12 hours after natural estrus is more beneficial that AI performing 24 hours after natural estrus because of higher pregnancy rate.

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