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Effect of estradiol concentration at time of AI on pregnancy outcomes in Indigenous cattle

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Abstract

In present study comparative analysis of plasma estradiol concentration at time of AI in pregnant and non-pregnant indigenous cows was done. Estrus synchronization was done in total 200 cows and blood samples were collected at time of AI. Pregnancy diagnosis was done on day 45 post-AI and in subset of 100 cows (50 pregnant and 50 non pregnant) plasma estradiol was measured through ELISA kit. Higher plasma estradiol concentration (pg/ml) was found in pregnant cows as compared to non-pregnant.

Keywords: Indigenous cow, estradiol, AI, pregnancy outcome

1. Introduction

India has a large population of humped cattle (*Bos indicus*) estimated to be 142.11 million (Livestock census, 2019) ^[1] and there are so far 43 registered native cattle breeds in India broadly classified into dairy, draft and dual purpose breed depending upon their utility either in dairying or in agriculture work. The indigenous breeds of cattle possess various unique characteristics such as the presence of unique genetic variation in HSP70 gene family, carry a 'thermometer gene' which makes them more thermotolerant thus less negative impact of hot humid climatic conditions on milk production as compared to cross breed and exotic population (Sodhi *et al.*, 2013) ^[10].

Estrogens are secreted from bovine adrenal, ovary, and placenta. Estrone, 17 β -estradiol, and 17 α -estradiol have been unequivocally identified in the cow, but only 17 β -estradiol has been tentatively identified in whole ovaries and follicular fluid. Also, estradiol concentrations on day of AI were found to effect subsequent pregnancy outcomes (Folman *et al.*, 1973). Vasconcelos *et al.* (1999) ^[4, 12] reported that increased levels of progesterone at time of A.I or some time before AI can lead to decreased conception rates. Thus increased estradiol at time of AI is conducive for better pregnancy outcomes (Vasconcelos *et al.*, 2103) ^[11]. Relationship between estradiol concentrations on day of AI and conception rate is well established for exotic cattle, crossbred and buffalo but reports including indigenous cattle are very rare. So, present study was intended to elucidate effect of estradiol concentrations on day of AI and conception rate in indigenous cattle.

2. Material and Method

The study was conducted on 200 indigenous cattle maintained at farms of Hisar and Jhajjar districts of Haryana during months of December to April, 2021. The experimental cows were kept in loose housing system under group management practice with provision of fresh drinking water and shelter was also provided to protect animals from climatic adversities. A total 200 cows were synchronized with Ovsynch based synchronization strategy and fixed time artificial insemination was performed 18-24 hours after last GnRH injection of Ovsynch protocol. Pregnancy diagnosis was done 45 days post-AI and 50 pregnant and 50 non pregnant cows out of total 200 were included in present investigation to elucidate effect of estradiol concentration on day of AI with conception rate.

2.1. Blood collection

10 ml blood was collected from jugular vein in heparinized 15 ml centrifuge vials at time of AI. Blood was brought to laboratory in cool cage within two hours after collection. Centrifugation was done at 1500Xg for 15 minutes to separate plasma, and plasma aliquots were stored in duplicates at -20 °C until analysis.

2.2. Hormonal analysis

Plasma estradiol-17 β was estimated using a commercially available Delayed Competitive binding ELISA Kit having sensitivity of 3.94 pg/ml in 100 cows (50 pregnant and 50 non-pregnant) selected out of total 200 cows.

2.3. Statistical analysis

Statistical analysis was performed in computer based SPSS software. Numerical data were presented as mean \pm SE. The student's t-test was employed to measure the differences in plasma E2 concentrations between pregnant and non-pregnant cows.

3. Results and Discussion

Retrospective analysis of plasma Estradiol concentrations at time of AI revealed that higher ($p < 0.01$) concentrations were found in cows which were diagnosed pregnant on day 45 post-AI than cows which were diagnosed non-pregnant (Table 1).

Table 1: Estradiol concentration (pg/ml) at time of AI in indigenous cows

	Estradiol concentration at time of AI (pg/ml)
Pregnant (n=50)	5.72 \pm 0.21
Non-pregnant (n=50)	4.62 \pm 0.16

Consistent to observation of present study, previous studies by Lopes *et al.* (2010)^[5]; Vasconcelos *et al.* (2013)^[11] on *Bos taurus* cows reported improved pregnancy outcomes with increased plasma estradiol concentration at time of AI. Similarly, Pandey *et al.* (2011)^[7] and (2018)^[8]; reported that plasma estradiol concentration on day of AI were higher in pregnant cows to compared to non-pregnant. Thus, optimal E₂ concentrations on day of estrus is a key for proper growth and coordination in important events like triggering LH surge, ovulation and resumption of meiosis as intrafollicular concentrations of E₂ may play a role in preparation of follicular cells for luteal formation and function as E₂ increased cellular proliferation of granulosa cells formation of gap junctions (Merk *et al.*, 1972)^[6], increased stimulatory action of follicle stimulating hormone on aromatase activity (Reilly *et al.*, 1996)^[9], enhanced stimulation of progesterin synthesis after gonadotropin stimulation (Fanjul *et al.*, 1984)^[3], and enhanced acquisition of luteinizing hormone receptors (Wang and Greenwald *et al.*, 1993)^[13]. Furthermore, the ability of luteinized granulosa cells to secrete progesterone was increased when cells were collected from follicles having increased follicular fluid concentrations of estradiol compared with granulosa cells collected from follicles with lower concentrations of estradiol, and secretion of progesterone was delayed in ewes given an aromatase inhibitor before induced ovulation (Benoit *et al.*, 1992)^[2]. It seems logical that the higher plasma E₂ on day of AI would have led to the LH surge, consequently timely ovulation that might have resulted in increased conception rate.

4. Conclusion

From present study it may be concluded that increased plasma concentrations at time of AI were associated with increased pregnancy outcomes in indigenous cattle but further studies are imperative to well establish this fact.

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