

COMPARATIVE STUDY OF CERTAIN REPRODUCTIVE HORMONES OF CATTLE REARED UNDER ISLAND AND COASTAL ECOSYSTEMS

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ABSTRACT

The basic difference in hormonal profile of cattle reared in two quite different ecosystems namely island and coastal ecosystem was estimated. The incidence of different infertility conditions in both the ecosystems also might vary as per the environment. Serum samples were collected for estimations of hormonal parameters like estrogen, progesterone, TSH, LH and FSH. The overall incidence of infertility was recorded to be 47.62 % in island and 45.90 % in coastal ecosystem. The animals were in same stage of estrus, when samples were collected for hormonal analysis. In case of repeat breeding, there was significant increase in mean estrogen concentration ($p < 0.05$) in coastal cattle than that of cattle reared under island ecosystem. Similarly, also significant increase in mean progesterone concentration ($p < 0.05$) of coastal cattle than that of island cattle was observed.

Keywords: Cattle, Coastal ecosystem, Estrogen, Island, Progesterone

Conception rate of dairy cows may drop 20-27 % in summer and heat stressed cows often have poor expression of oestrus due to reduced oestradiol secretion from the dominant follicle, developed in a low luteinizing hormone environment (Naqvi *et al.*, 2012). Lower peak values of estrogen around oestrus along with decreased progesterone concentration are attributed to be the major reasons, responsible for a higher incidence of silent oestrus during summer (Rao and Pandey, 1982). The fertility rate of high yielding dairy cows is lowered during summer and even remains lower during autumn as compared to winter. It is a well known fact that, lactating cows are more adversely affected than heifers (Takahashi, 2012), due to their much greater internal heat production. High environmental temperature on the day after insemination was associated with lower conception rates (Nabenishi *et al.*, 2011). Exposure of cattle to elevated temperatures during oocyte maturation and ovulation (Putney *et al.*, 1989) or during the first 3 or 7 days of pregnancy, decreased embryonic viability and development (Hansen, 2013). Heat stress has been reported to alter follicular development by reducing steroid hormone production (Wilson *et al.*, 1998) and these changes in follicular steroid concentration could disrupt oocyte maturation. In addition, heat stress reduces growth of the dominant follicle and causes incomplete dominance so that there is increased growth of subordinate follicles (Bajagai, 2011). Two different and contrasting environments like island ecoculture of Andaman and coastal area of Odisha differ very much in their topography and climate. Similarly, the availability of forage and mineral status of

soil/ forage also greatly differ from each other. These factors might have an effect in prevalence of different infertility conditions and reproductive status of cattle through an altered hormonal status of animals. Further, the livestock sector under the islands ecosystem enjoys the benefit of disease free status being isolated from the mainland, India (Sunder, 2014). With this picture in mind, this experiment was conducted to compare the levels of certain reproductive hormones of cattle reared under two entirely different ecosystems viz. island and coastal.

MATERIALS AND METHODS

The present study was conducted in the Department of Animal Reproduction, Gynaecology and Obstetrics, College of Veterinary Science and Animal Husbandry, OUAT, BBSR and ICAR-Central Island Agricultural Research Institute, Portblair (Andaman and Nicobar Island) in two different agro-climatic zones from 1st January, 2019 to 30th June, 2019 to compare their reproductive performance. The animals were fed with area specific mineral mixtures in both the zones. Crossbred cattle with the history of anoestrus and repeat breeding were considered for the present investigation. The contour, consistency, tonicity and the patency of the cervix and uterine horns were assessed by careful manipulation and handling. The ovaries were palpated gently after retracting the cervix and uterus, cranio-ventral and slightly lateral to the bifurcation of uterine horns. When cradled between middle and index finger, the surface of the ovary was explored.

The cattle of island (Andaman & Nicobar) ecoculture and coastal climate (Odisha) were surveyed for presence of different infertility conditions such as delayed

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maturity, anestrus, repeat breeding and infected reproductive tract.

Twenty four cattle (12 each for anestrus and repeat breeding category) from island area and 24 cattle (12 each for anestrus and repeat breeding category) from coastal area were estimated for certain reproductive hormones (estrogen, progesterone, TSH, FSH and LH) by ELISA method. The animals were grouped as true anestrus, repeat breeding (Island) and true anestrus, repeat breeding (Coastal). All the data generated in the above experiments were statistically analyzed using SPSS (1996) computer package.

RESULTS AND DISCUSSION

In the present investigation, the incidence of various reproductive disorders in cows in both island and coastal ecosystems have been scrutinized from the clinical data sheets of TVCC, CVSc. and A.H., OUAT, Bhubaneswar and ICAR-Central Island Agricultural Research Institute, Portblair is presented in Table 1 and Table 2.

In coastal ecosystem, the incidence (Table 2) of delayed puberty, anestrus, repeat breeding, reproductive tract infections and miscellaneous causes were found to be 4.75 %, 19.67 %, 15.99 %, 3.19 % and 2.30 %, respectively with overall infertility rate of 45.90 %. The incidence as observed in present observation corroborates the report of

Sreenivas *et al.* (1997) and Ray *et al.* (2004). In island ecosystem, the incidence of different types of infertility were found to be 3.33%, 19.71%, 17.61%, 4.95% and 0.02%, respectively in the same order, overall infertility rate being 47.62 %. Due to lack of literature, it was difficult to compare with other's findings. However, in island ecosystem delayed puberty, anestrus, and miscellaneous causes of infertility were found be less which might be due to availability of nutrition through green forage and natural mineral supplementation in the island ecosystem as compared to coastal ecosystem (Chaurasia *et al.*, 2020a). But, repeat breeding and reproductive tract infections are somewhat little higher as compared to coastal ecosystem which might be due to less knowledge level of the farmer and non-adoption of improved managerial practices (Chaurasia *et al.*, 2020b).

The mean estrogen and progesterone concentrations of anestrus and repeat breeder cattle reared under both ecosystems are depicted in Table 3. The animals were in same stage of estrus, when samples were collected for hormonal analysis. Statistical analysis of the data revealed that there was no significant difference in estrogen concentration between the anestrus cattle reared in both coastal and island ecosystems. But, in case of repeat breeding, there was significant increase in mean estrogen concentration ($p < 0.05$) in coastal cattle than that of island cattle. Further, there was no significant difference in progesterone concentration between the anestrus cattle reared in both coastal and island ecosystems. But, in case of repeat breeding, there was significant increase in mean progesterone concentration ($p < 0.05$) of coastal cattle than that of island cattle. If the pituitary hormone secretions were poor, the animal was unable to express its effect on the gonads for secretion of gonadal hormones. This might be due to underfeeding and parasitic infections (Roberts,

Table 1

Percentage of different infertility conditions in cattle reared in two different agro-climatic regions

Different Infertility Conditions	Island Ecosystem (%)	Coastal Ecosystem (%)
Delayed Maturity	7.00	10.35
Anestrus	41.40	42.85
Repeat Breeding	37.00	34.82
Infected Reproductive Tract (IRT)	10.40	6.96

Table 2

Prevalence of different infertility conditions in cattle in island and coastal ecosystems

Category	Island ecosystem			Coastal ecosystem		
	Frequency (No. of cases)	% out of total	% out of infertile	Frequency (No. of cases)	% out of total	% out of infertile
Total surveyed	1050	-	-	1220	-	-
Total Infertile	500	47.62	-	560	45.90	-
Delayed puberty	35	03.33	7.00	58	04.75	10.35
Anestrus	207	19.71	41.40	240	19.67	42.85
Repeat breeding	185	17.61	37.00	195	15.99	34.82
Reproductive tract infections	52	04.95	10.40	39	03.19	6.96
Miscellaneous	21	00.02	4.20	28	02.30	5.00

Table 3

Level of gonadal hormones in anestrus and repeat breeding cows reared under different ecosystems

Hormones	Island ecosystem (Mean±SE) (n=12)		Coastal ecosystem (Mean±SE) (n=12)		'P' Value	
	Anestrus	Repeat breeding	Anestrus	Repeat breeding	Anestrus	Repeat
Estrogen (pg/ml)	3.86±0.06	6.15 ^a ±0.14	3.94±0.08	6.73 ^b ±0.11	0.417	0.005
Progesterone (ng/ml)	0.37±0.03	3.46 ^a ±0.10	0.41±0.05	3.91 ^b ±0.05	0.489	0.001

Means with different superscripts within a row differ significantly

Table 4

Level of other reproductive hormones in repeat breeding cows reared under different ecosystems

Hormones	Island ecosystem (n=12)	Coastal ecosystem (n=12)	'P' Value
LH (mIU/ml)	0.82±0.03	0.90±0.07	0.341
FSH (mIU/ml)	1.91±0.12	2.06±0.13	0.431
TSH (nmol/L)	31.1±1.88	34.01±1.91	0.295

1981).

The mean LH concentration of anestrus cattle in island ecosystem was 1.07 ± 0.17 mIU/ml, whereas in case of coastal cattle it was 1.12 ± 0.14 mIU/ml. The mean FSH concentration in case of island cattle was 0.97 ± 0.06 mIU/ml against 1.01 ± 0.08 mIU/ml in coastal cattle. Similarly, the mean TSH concentration was recorded to be 42.15 ± 4.42 in island cattle while it was 44.31 ± 2.58 in case of coastal cattle. Statistical analysis of the data revealed that there is no significant difference in the values of LH, FSH and TSH between the cattle of both coastal and island ecosystems. The TSH was a metabolic hormone which indirectly helped the reproduction in the absence of proper effect of FSH and LH. TSH also behaved similarly resulting in anestrus (Roberts, 1981).

The Mean LH, FSH and TSH concentration of repeat breeder cattle reared under both coastal and island ecosystem are depicted in Table 4. Statistical analysis of the data did not reveal any significant difference in the values of LH, FSH and TSH between the cattle of coastal and island ecosystems.

The mean level of estrogen concentration of anestrus cow (Table 3) in coastal ecosystem was found to be 3.94 (pg/ml). The present finding is in consistence with the findings of Parida (2015) and Hafez (2019). In island ecosystem, the mean estrogen concentration of anestrus cows were found to be 3.86 (pg/ml). Due to paucity of literature, it is not possible to make comparison with other island cattle. However, the values were comparable to

those of coastal ecosystem. The reason for ovarian subactivity might be insufficient synthesis or secretion of gonadotropins required for follicular development (Hafez, 2019). The mean progesterone concentration was found to be 0.37 and 0.41 (ng/ml) in anestrus condition of island and coastal ecosystem, respectively. Many reports have corroborated the present findings (Mc Donald, 1980 and Hafez and Hafez, 2000).

CONCLUSION

There was significant increase in mean estrogen and progesterone concentrations ($p < 0.05$) in coastal repeat breeding cattle than that of cattle reared under island ecosystem.

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