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Comparison of haematological profile of cattle reared under island and coastal ecosystem

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Abstract

The present study was conducted in the Department of Animal Reproduction Gynaecology and Obstetrics, College of Veterinary Science and Animal Husbandry, OUAT, BBSR in collaboration with ICAR-Central Inland Agricultural Research Institute, Portblair (Andaman and Nicobar Island). Crossbred cattle with the history of anoestrus and repeat breeding were considered for the present investigation. The basic difference in haematological profile of cattle reared under two quite different ecosystems namely Island and coastal ecosystem was estimated which might be due to the variability in rainfall, ambient temperature, day light length and humidity. The incidence of different infertility conditions in both the ecosystems also might vary as per the environment. Serum samples were collected and analysed for various haematological parameters such as haemoglobin, total erythrocyte count (TEC), packed cell volume (PCV), total leukocyte count (TLC) and differential leukocyte count (DC). The overall incidence of infertility was recorded to be 47.62% in island and 45.90% in coastal ecosystem. In case of anoestrus, the PCV, Hb, TEC, TLC values were significantly higher ($p < 0.05$) in island cattle as compared to coastal cattle. The lymphocyte value was significantly higher ($p < 0.05$) in case of coastal cattle as compared to cattle reared under island ecosystem. But in case of repeat breeding the Hb, TEC, TLC and eosinophil values were significantly higher ($p < 0.05$) in island cattle as compared to cattle reared under coastal ecosystem. It was concluded that the variations in humidity, ambient temperature, rain fall and day light length between Portblair, Andaman and coastal climate of Odisha, did not have much effect on reproduction of cattle.

Keywords: Cattle, costal ecosystem, haematological profile, island

Introduction

Conception rate of dairy cows drops 20-27% in summer and results in poor expression of oestrus due to reduced oestradiol secretion from the dominant follicle, developed in a low LH environment^[7]. The fertility rate of high yielding dairy cows is lowered during summer and even remains lower during autumn as compared to winter. The lactating cows are more adversely affected than heifers due to their much greater internal heat production^[15]. Maximum environmental temperature was associated negatively with conception rates^[6]. Exposure of cattle to elevated temperatures during oocyte maturation and ovulation^[10] or during the first 3 or 7 days of pregnancy decreased embryonic viability and development^[3]. Study also revealed that it causes reduction in HB, MCH and MCV values and increase in leukocyte count under high environmental temperature^[11]. The high temperature also lowers fat %, total protein, IgG, IgA, lactose level and increases pH of milk^[8]. Two different and contrasting environments like island ecoculture of Andaman and costal 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. With this picture in mind, this experiment was conducted to compare the haematological profile of cattle reared under two entirely different ecosystems viz. island and costal.

Materials and Methods

The present study was conducted in Crossbred cattle with the history of anoestrus and repeat breeding in two different agro-climatic conditions, i.e. in Bhubaneswar and Portblair. The different parts of reproductive system were carefully examined manually.

A total of 500 cattle in island (Andaman & Nicobar) eco-culture and 560 cattle in coastal climate (Odisha) were surveyed for presence of different infertility conditions.

Table 1: Type of ecosystem

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
Miscellaneous	4.20	5.00

The meteorological data such as rainfall, maximum, and minimum temperature and humidity were collected pertaining to both the ecosystems. 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 different haematological profile (PCV, Hb, TEC, TLC, neutrophil, lymphocyte, eosinophil and monocyte). The animals were grouped as Anestrus (Island), repeat breeding (Island) and Anestrus (Coastal), repeat breeding (Coastal). All the data generated in the above experiments were statistically analyzed using SPSS (1996) computer package. Charts were done with the help of Data analysis tool of Office 2010 of Microsoft in the computer.

Results

In the present investigation the incidence of various reproductive disorders in cows in both island and coastal ecosystem have been scrutinized from clinical data sheets and is presented in table 2.

Table 2: Prevalence of different infertility conditions in cattle in Island and coastal ecosystems

Category	Island ecosystem			Coastal ecosystem		
	Frequency	% out of total	% out of infertile	Frequency	% 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

The haematological parameters of anestrus cattle reared under different ecosystems are depicted in table 3. The mean PCV (%) for anestrus cattle reared under island ecosystem was 31.04 ± 0.46 and for coastal cattle was 28.63 ± 0.64 . The mean Hb (g/dl) values recorded were 13.60 ± 0.37 in case of island cattle and 11.33 ± 0.27 for coastal cattle. The mean TEC ($10^6/\mu\text{l}$) value in case of island and coastal cattle was 9.13 ± 0.15 and 7.23 ± 0.16 respectively. The mean TLC ($10^3/\mu\text{l}$) value was found to be 16.68 ± 0.39 in case of island cattle where as 14.22 ± 0.33 for coastal cattle. The mean neutrophil (%) for island cattle was 32.75 ± 0.61 and in case of coastal cattle it was 31.66 ± 0.49 . Similarly the mean lymphocyte (%) for island and coastal cattle was 60.91 ± 0.70 and 62.91 ± 0.37 respectively. The mean eosinophil (%) in case of island cattle was 4.41 ± 0.28 and 3.75 ± 0.35 for coastal cattle whereas the mean monocyte (%) for island and coastal cattle were 1.91 ± 0.19 and 1.66 ± 0.18 respectively.

Statistical analysis of the data revealed that there was no significant difference in the values of neutrophil, eosinophil and monocyte between the cattle of both coastal and island ecosystem. But, the PCV value was significantly higher ($p < 0.05$) in case of island cattle as compared to coastal cattle. The Hb, TEC, TLC values were also significantly higher ($p < 0.05$) in case of island cattle as compared to coastal cattle. The lymphocyte value was significantly higher ($p < 0.05$) in case of coastal cattle as compared to cattle reared under island

ecosystem.

Different hematological parameters of cattle both anestrus and repeat breeding reared under both the ecosystems are presented in table 3.

The mean PCV (%) for repeat breeder cattle reared under island ecosystem was 37.98 ± 0.62 and for coastal cattle was 36.37 ± 0.78 . The mean Hb (g/dl) values were recorded to be 13.51 ± 0.30 in case of island cattle and 11.24 ± 0.33 for coastal cattle. The mean TEC ($10^6/\mu\text{l}$) value in case of island and coastal cattle was 8.35 ± 0.19 and 7.18 ± 0.17 respectively. The mean TLC ($10^3/\mu\text{l}$) value was found to be 13.91 ± 0.42 in case of island cattle where as 12.13 ± 0.43 for coastal cattle. The mean neutrophil (%) for island cattle was 35.16 ± 0.54 and in case of coastal cattle it was 34.58 ± 0.89 . Similarly the mean lymphocyte (%) for island and coastal cattle was 58.58 ± 0.82 and 60.41 ± 0.95 respectively. The mean eosinophil (%) in case of island cattle was 4.33 ± 0.35 and 3.33 ± 0.25 for coastal cattle whereas the mean monocyte (%) for island and coastal cattle were 1.91 ± 0.22 and 1.66 ± 0.14 respectively.

Statistical analysis of the data revealed that there was no significant difference in the values of PCV, neutrophil, lymphocyte and monocyte between the cattle of coastal and island ecosystem. But, The Hb, TEC, TLC and eosinophil values were significantly higher ($p < 0.05$) in case of island cattle as compared to coastal cattle.

Table 3: Hematological estimate in anestrus and repeat breeding cows reared under different ecosystems

Parameters	Repeat breeding		'P' Value	Anestrus		'P' Value
	Island ecosystem (n=12)	Coastal ecosystem (n=12)		Island ecosystem (n=12)	Coastal ecosystem (n=12)	
PCV (%)	37.98 ± 0.62	36.37 ± 0.78	0.124	$31.04^a \pm 0.46$	$28.63^b \pm 0.64$	0.006
HB (gm/dl)	$13.51^a \pm 0.30$	$11.24^b \pm 0.33$	0.000	$13.60^a \pm 0.37$	$11.33^b \pm 0.27$	0.000
TEC ($10^6/\mu\text{l}$)	$8.35^a \pm 0.19$	$7.18^b \pm 0.17$	0.000	$9.13^a \pm 0.15$	$7.23^b \pm 0.16$	0.000
TLC ($10^3/\mu\text{l}$)	$13.91^a \pm 0.42$	$12.13^b \pm 0.43$	0.008	$16.68^a \pm 0.39$	$14.22^b \pm 0.33$	0.000
Neutrophil (%)	35.16 ± 0.54	34.58 ± 0.89	0.583	32.75 ± 0.61	31.66 ± 0.49	0.185

Lymphocyte (%)	58.58 ± 0.82	60.41 ± 0.95	0.160	60.91 ^a ± 0.70	62.91 ^b ± 0.37	0.020
Eosinophil (%)	4.33 ^a ± 0.35	3.33 ^b ± 0.25	0.032	4.41 ± 0.28	3.75 ± 0.35	0.156
Monocyte (%)	1.91 ± 0.22	1.66 ± 0.14	0.364	1.91 ± 0.19	1.66 ± 0.18	0.364

Means with different superscripts (a, b) within a row differ significantly

Discussion

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 Ray *et al.* (2004) and Sreenivas *et al.* (1997) [12 and 14]. 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. No statistical difference could be found to exist in between both the ecosystems after angular conversion. However, in island ecosystem delayed puberty, anestrus, and miscellaneous causes of infertility were found to 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. 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 managemental practices.

To maintain homeostasis and physiological equilibrium haemoglobin, which is a major constituent of erythrocyte, is primarily considered. In conditions like anaemia, haemorrhage, toxemia, shock and poisoning, its level decreases significantly. In the present study, the Haemoglobin concentration (g/dl), are well within normal range in animals reared under both the ecosystems [4]. A significantly ($P < 0.01$) low level of Hb is detected in coastal repeating animals. The level of haemoglobin fluctuates due to genotype, stress and pregnancy. The discrepancy in its concentration in different treatment groups might be attributed to bacterial invasion of endometrium, which deviates the normal uterine environment. The present values of haemoglobin found the support of Prabha and Singh (2000) and Singh *et al.* (2000) [9 and 13]. Moreover, island cattle have more access to greens which are rich source of vitamin A, which might be responsible for higher Hb in repeater cattle [1].

The TEC ($10^6/\mu\text{ml}$) is directly proportional to the haemoglobin concentration. In the present experiment the values of both anestrus and repeat breeding cattle in both ecosystems had the TEC value well within the physiological range [4]. The anestrus and repeaters both have registered lesser TEC value in coastal area. During normal inflammatory process and infection there is lots of death of blood cells, which need regeneration and haemopoiesis to overcome the shortfall. The immunity of the animal counts most to quick response towards normalcy. Heavy parasitism, lack of greens and use of fertilizers in soil might have an effect in low TEC level in coastal area [1].

The total leucocyte count ($10^3/\mu\text{ml}$) recorded during the present experiment are well within normal range [4]. The animals of coastal area recorded significantly ($P < 0.01$) lower values of TLC. This might be due to healthiness of animals without history of any calving complication in past. The present finding is in partial agreement with Ray *et al.* (2004) and Singh *et al.* (2000) [12 and 13]. However, higher values have

also been reported [9].

The present PCV (%) during the present study were well within normal range [4]. However, lower PCV have also been reported [2]. The present finding finds the support of Garan *et al.* (2010) [2], which might have further influenced by natural environment. The higher PCV value in repeat breeder of island cattle might be due to less stress on animals [1]. However, most of our result, finds support of Kumar *et al.* (1986) [5]. The PCV ultimately is dependent on the number of blood cells present and their subsequent proliferation, which is highly variable under different physiological status of animals.

The Neutrophil (%) in the present study in both areas is well within normal physiological range [4]. The variation in neutrophil count might be due to innate activation of immune system. Microbial infection tends to release different chemotactic molecules, which has got vasodilatory effect. Further, the variation in neutrophil count may be attributed to allergic stimulation, as neutrophils are considered as first line of defence. Ray *et al.* [12] have reported a much lesser value of neutrophil% (25.30 ± 2.17). In the present study there is no significant variation in neutrophil count in any class and any ecosystem.

The present value of Lymphocyte (%) is well within the physiological limit [4]. Our present finding of normal range of lymphocytosis also finds the support of Ray *et al.* [12], who recorded lymphocytosis to the tune of 60%. Lymphocytes constitute the largest proportion of agranulocytes in bovine blood. It imparts the immune competency to the animal. Lymphocytes are large nuclear mobile cells which penetrate to different lymphnodes and other lymphoid organs from blood. A population of highly specialized plasma cells are also a fraction of lymphocytes. This being the precursor of immunoglobulin, forms humoral antibodies. Similarly, B-lymphocytes contribute towards cellular immunity. A stimulus that provokes immune response, can act as antigenic thrust. This might have affected in the marginal decrease on different days of sampling. The temporary depression in lymphocyte count might be due to their primary response to a bacterial antigen. This might be the cause of significantly ($P < 0.01$) higher lymphocyte % in coastal cattle which are mostly prone to infection.

The monocyte (%) count recorded in the present study was towards lower range [4]. The present finding of eosinophil % is well within the physiological range [4].

Elevation of eosinophil count usually is marked in wasting disease, allergic reaction and parasitic infestations. The cattle in island ecosystem possessed significantly ($p < 0.01$) higher percentage of eosinophils in blood than the cattle reared under coastal ecosystem. The reason may be attributed to excess rain causing stress on animals and therefore parasitic infections. Moreover, farmers of coastal area are enlightened regularly about use of anthelmintics year round to save the animals. Since, farmers under island ecosystem are mostly tribal with low knowledge level and there is poor health coverage, which increases the chance of parasitism. Of course, the trace mineral estimation could have been used to rule out deficiency of any mineral or presence of specific allergen in the hilly and island terrain, which might be a factor

for causing eosinophilia ^[1]. High eosinophilia has nowhere been reported to be a cause of repeat breeding. However, it cannot be denied arbitrarily.

Conclusion

The comparative study on climate, incidence of cattle infertility and hormonal estimation between cattle reared in island ecoculture of Andaman and coastal ecoculture of Odisha revealed that the change in humidity, ambient temperature, rain fall and day light length did not have much effect on reproduction of cattle. The overall incidence of infertility was recorded to be 47.62% in island and 45.90% in coastal ecosystem. In case of anestrus, the PCV, Hb, TEC, TLC values were significantly higher ($p < 0.05$) in island cattle as compared to coastal cattle. The lymphocyte value was significantly higher ($p < 0.05$) in case of coastal cattle as compared to cattle reared under island ecosystem. In case of repeat breeding, the Hb, TEC, TLC and eosinophil values were significantly higher ($p < 0.05$) in island cattle as compared to cattle reared under coastal ecosystem.

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