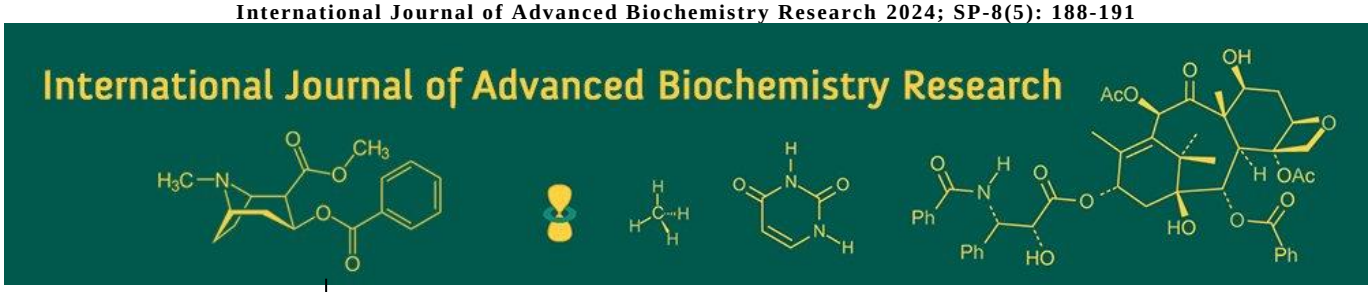

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Serum biochemical profiles between repeat breeder and normal cyclic jersey crossbred cows

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Abstract
The present study on serum biochemical constituents was carried out in repeat breeder and normal cyclic Jersey crossbred cattle. A total of 32 healthy Jersey crossbred cattle (n=32), aged 3-6 years with body condition score of 5-6 were selected and divided into two groups, each group comprised of twelve (n=16) animals (Group I: Repeat breeder, Group II: Normal cyclic). As per the schedule of the farm, experimental cows were properly vaccinated and dewormed. In morning, prior to concentrate feeding, the blood samples were collected in heparinized vacutainer and immediately transported to the laboratory. The blood samples were centrifuged at 3000 × g for 15 min. Serum samples were separated and kept at -20 °C until estimation of biochemical profiles. Concentration of serum total protein, albumin, globulin, glucose and creatinine was significantly (p<0.05) higher in normal cyclic as compared to repeat breeder. However, in repeat breeder cows had significantly higher concentration of total cholesterol and BUN as compared to normal cyclic cows. Similarly, Calcium concentration was significantly higher in normal cyclic group as compared to repeat breeder. However, the serum P was non significantly higher in repeat breeder as compared to normal cyclic group. These serum biochemical constituents might have played a vital role in the physiological cyclicity of these cows, and these essential nutrients could be added in diet to avoid repeat breeder syndrome in Jersey crossbred cows.

Keywords: Biochemical analytes, repeat breeder, normal cyclic, jersey cows

Introduction
Reproductive disorders are often complex and multifactorial, which are determined by their nature and severity lead to various degrees of suboptimal fertility performance; Reproductive tract abnormalities, endocrine disorders, infectious causes, such as malnutrition, and problems with artificial insemination (AI) techniques are among the factors linked to infertility or embryonic death (Singh and Pant, 1999) [1]. One of the major reproductive diseases affecting domestic animals is repeat breeding (RB), which has a significant negative financial impact on India's dairy sector.

A repeat breeder is a cyclic nonbreeder dairy cow that shows typical indications of estrus every 18 to 24 days and has not given birth after three or more attempts at conception (Parkinson 2001) [2]. According to Patel *et al*. (2007) [3], the frequency of repeat breeding in buffaloes is higher than that of cattle (8.68% vs. 18.79%). Breed, farm, agroclimatic, and management factors all affect the occurrence. Repeat breeding appears to have a complex etiology that includes inadequate nutrition, hormonal dysfunctions, uterine infections, and poor breeding and health care [4]. Breed, age, and season of birth are the main risk factors for repeat breeding in cattle and buffalo [5]. Maintaining normal levels of vital haemato-biochemical constituents is essential for maintaining the functional integrity of the reproductive system. Any modification to the haematological and biochemical parameters may have an adverse effect on the efficiency of livestock reproduction. It is crucial to maintain normal levels of essential haemato-biochemical constituents to preserve the reproductive system's functional integrity. Any alteration in biochemical parameters could have a negative impact on livestock reproduction efficiency. The present work was undertaken to compare the biochemical parameters between repeat breeding and normal cycling jersey crossbred cows raised in delta region of Tamil Nadu.

Materials and Methods

The current study was conducted at the TANUVAS-Veterinary College and Research Institute in Orathanadu, Thanjavur, Tamil Nadu, India, in the Department of Veterinary Physiology and Biochemistry. The institute is situated at latitudes 10.6°N and 79.3°W, thirty metres above mean sea level (MSL). Experimental animals were selected from an organised farm from Thanjavur district, Tamil Nadu, India. A total of 32 healthy Jersey crossbred cattle, aged about 3-6 years were selected and each group consisted of 16 animals (n=16) animals viz., Group I: Repeat breeder (R), Group II: Normal cyclic (N). Before concentrate feeding in the morning, blood samples were drawn into a heparinized vacuum-sealed bag and sent to the laboratory immediately. Blood samples were centrifuged for fifteen minutes, at 3000 × g. The serum was separated and kept cold (-20 °C) until needed. Serum biochemical parameters include creatinine (mg/dL), glucose (mg/dL), total protein (TP; g/dL), albumin (g/dL), globulin (g/dL), glucose total cholesterol (mg/dL), BUN, Creatinine, Ca and P was done. Using a UV spectrophotometer and Span Diagnostic kits in accordance with accepted biochemical practices, these parameters were examined. Experimental Jersey crossbreed cows were fed with 2 kg of concentrate and roughage as per the requirement. Animals were properly vaccinated and dewormed as per farm schedule and water supplied as ad libitum.

Results

The mean serum biochemical constituents of G I: (R) Repeat breeder Jersey Crossbred cattle, G II: (N) Normal cyclic cows were presented in Table 1.

Table 1: Mean serum biochemical constituents of repeat breeder Vs normal cyclic Jersey Crossbred cattle

Parameter	Group -I Repeat breeder	Group -II Normal cyclic
Total protein (g/dL)	6.59±0.13	8.43±0.07*
Albumin (g/dL)	3.14±0.13	3.71±0.07*
Globulin (g/dL)	3.45±0.03	4.66±0.06*
A/G ratio	1:0.95±0.45	1:0.80±0.02
Glucose (mg/dL)	46.64±3.74	57.14±0.81*
Total cholesterol (mg/dL)	155.64±0.52*	143.49±2.74
BUN (mg/dL)	34.3±0.02*	28.94±0.75
Creatinine (mg/dL)	0.95±0.13	1.23±0.03*
Ca (mg/dL)	8.41±0.13	10.59±0.14*
P (mg/dL)	7.31±0.02	6.21±0.06

*Significant (p<0.05)

Total protein (g/dL)

The total protein concentration was significantly lower (p<0.05) in repeat breeder G I (R) (6.59±0.13) as compared to regular cyclic G II (N) (8.43±0.07) animals.

Albumin (g/dL)

The total mean albumin concentration was significantly lower (p<0.05) in repeat breeder G I (R) (3.14±0.13) as compared to normal cyclic G II (N) (3.71±0.07) cows.

Globulin (g/dL)

The serum globulin concentration was significantly higher (p<0.05) in repeat breeder G I (R) (3.45±0.03) as compared to normal cyclic animals G II (N) (4.66±0.06).

A: G ratio

The A:G ratio concentration was significantly lower (p<0.05) in repeat breeder G I (R) (1:0.95±0.95) as compared to normal cyclic G II (N) (1:0.80±0.02) cows.

Discussion

Total protein (g/dL)

The total protein concentration pattern observed in the present study was in accordance with the results of Chandrahar *et al*. (2003) [6], Mondal and Paul, 2012 [7] Sabasthin *et al*. (2012) [8], Amle *et al*. (2014) [9], Kekan and Shirbhate (2015) [10] and Widayati *et al* (2018) [11]. Chandrahar *et al*. (2003) [6] observed that the TP concentration was ranged from 6.27-9.86 with an average of 8.02 in normal fertile cows as compared to 6.5-8.06 with an average of 6.94 in repeat breeder cows. Similarly, Mondal and Paul, (2012) [7] reported that serum protein levels were low in repeat breeding cows (5.52) than the normal cyclic cows (5.71). Likewise, Sabasthin *et al*. (2012) [8] observed the TP concentration in repeat breeder (6.5) cow's vs normal cyclic cows (7.0). Correspondingly, Amle *et al*. (2014) [9] recorded that TP concentration in normal cyclic crossbred cows (6.57) as compared to repeat breeder cows (5.46). Equally, Kekan and Shirbhate (2015) [10] observed total protein level was non-significantly lower in repeat breeder cows (7.95±0.04) than regular cyclic cows (9.15±0.04). Likewise, Widayati *et al* (2018) [11] recorded that the total protein concentration was significantly higher in fertile cyclic (8.68±0.58) cows than repeat breeder (5.67±0.86). On contrary, higher protein concentration was observed in repeat breeder than normal cyclic groups by Cetin *et al*. (2002) [12] and Ahmed *et al*. (2017) [13]. Cetin *et al*. (2002) [12] reported lower protein concentration (8.26) in fertile cyclic cows Vs (8.5) in repeat breeder cows. Similarly, Ahmed *et al*. (2017) [13] reported that TP plasma levels of RB (4.5±0.3) were significantly higher in repeat breeder than that of the NC cows (4.3±0.6). Also, Kumar *et al*. (2009) [14] reported the TP concentration in repeat breeder 7.59 cow's vs normal cyclic cows 7.39.

Albumin (g/dL)

The serum albumin concentration was within the reference range in normal cyclic cows. However, it was lower in repeat breeders. Results were in consonant with the results of Mondal and Paul (2012) [7]; Amle *et al*. (2014) [9] and Sabasthin *et al*. (2012) [8]. Similarly, Mondal and Paul, (2012) [7] reported that the albumin were low repeat breeding cows (2.71) than the normally cyclic cows (2.81). Correspondingly, Sabasthin *et al*. (2012) [8] observed that the albumin concentration in repeat breeder (3.0) cows Vs normal cyclic cows (3.2). Likewise, Amle *et al*. (2014) [9] reported that albumin concentration in normal cyclic crossbred cows (3.84) as compared to repeat breeder cows (3.37). However, opposing results were observed by Chandrahar *et al*. (2003) [6] and Ahmed *et al*. (2017) [13]. In a study, Chandrahar *et al*. (2003) [6] recorded that the albumin concentration (mg%) was ranged from 1.56 - 2.23 with an average of 1.94 in normal fertile cows as compared to 2.57-3.68 with an average of 2.80 in repeat breeder cows. Similarly, Ahmed *et al*. (2017) [13] reported that in Jersey cows, lower albumin 3.64 Vs 3.76 in repeat breeder cows were observed. The lower protein and albumin concentration in repeat breeder cows might be associated with low nitrogen intake and retention in the body.

Globulin (g/dL)

The serum globulin concentration was within the reference range in normal cyclic cows. Ahmed *et al*. (2017) [13] reported that in Jersey cows, the concentration of globulin was 4.6 in normal cyclic Vs 4.7 in repeat breeder Jersey cows. Similarly, Mondal and Paul, (2012) [7] observed that the globulin concentration was low in repeat breeding cows (2.89) than the normally cyclic cows (2.82). Likewise, Sabasthin *et al*. (2012) [8] reported the globulin concentration in repeat breeder (3.5) cows Vs normal cyclic cows (3.8). Similarly, Amle *et al*. (2014) [9] reported that globulin concentration in normal cyclic crossbred cows (2.73) as compared to repeat breeder cows (2.09). Reduced globulin concentrations affect the biosynthesis of specific coenzymes, which hinders the synthesis of steroids in RB dairy cows during the early luteal phase of the estrus cycle Khan *et al*. (2010) [15]. Additionally, globulin, an amino acid, functions as a protein carrier for copper (Cu).

A: G ratio

The A:G ratio observed in the present study was within the reference range in normal cyclic cows. To accord with the present results, Ahmed *et al*. (2017) [13] reported that the A: G ratio in repeat breeding cows was (0.97) as compared to normal cyclic cows (0.96). Similarly, Amle *et al*. (2014) [9] reported that A:G ratio concentration in normal cyclic crossbred cows (1.40) as compared to repeat breeder cows (1.99).

Glucose (mg/dL)

The serum glucose concentration was within the reference range in normal cyclic cows and it was observed higher than the repeat breeders. Results were in agreement with the results of Chandrahar *et al*. (2003) [6], Sabasthin *et al*. (2012) [8], Amle *et al*. (2014) [9], Kekan and Shirbhate (2015) [10] and Widayati *et al* (2018) [11]. Chandrahar *et al*. (2003) [6] reported that glucose concentration (mg%) was ranged from 66-75 with an average of 70.41 in normal fertile cows as compared to 55.88-67.64 with an average of 60.43 in repeat breeder cows.. Similarly, Sabasthin *et al*. (2012) [8] observed the glucose concentration in repeat breeder (38.05) cows Vs normal cyclic cows (63.48). On contrary, Cetin *et al*. (2002) [12] reported that lower glucose concentration (46.26) in fertile cyclic cows Vs (52.33) in repeat breeder cows. Likewise, Ahmed *et al*. (2004) [16] reported that lower glucose concentration (50.72) in fertile cyclic cows Vs (50.56) in noncyclic cows. In another study, Ahmed *et al*. (2017) [13] observed that the total glucose concentration of RB (58.4±17.8) was significantly lower in repeat breeder than that of the NC cows (75.2±26.9). Reduced blood glucose levels in RB cows may be related to increased peripheral glucose absorption, inhibition of glycogenolysis or gluconeogenesis, and endogenous hyperinsulinemia (Mukherjee *et al*. 2011) [17]. Additionally, a higher frequency of RBS and anestrus are associated with glucose insufficiency (Jani *et al*., 1995) [18].

Cholesterol (mg/dL)

The serum cholesterol concentration was higher in repeat breeder cows than normal cyclic cows. Results were in consonance with the results of Cetin *et al*. (2002) [12]; Ahmed *et al*. (2017) [13] and Widayati *et al* (2018) [11]. To accord with this, Ahmed *et al*. (2017) [13] reported that the total cholesterol concentration was significantly higher in repeat breeder (87.94±30.2) than that of the NC cows (74.5±37.9). Similarly, Chandrahar *et al*. (2003) [6] observed that the Cholesterol concentration (mg%) was ranged from 95.23-219 with an average of 165.75 in normal fertile cows as compared to 142.85-247 with an average of 182.37 in repeat breeder cows. correspondingly, Cetin *et al*. (2002) [12] reported that higher cholesterol concentration (138.93) in repeat breeder cows Vs (128.20) in fertile cyclic cows. Likewise, Widayati *et al* (2018) [11] reported that the total cholesterol concentration of RB (151.45±26.25) was significantly higher in repeat breeder than that of the NC cows (124.65±12.84). On contrary, Kekan and Shirbhate (2015) [10] recorded total cholesterol level was non-significantly lower in repeat breeder cows (111.6) than regular cyclic cows (127.3). According to Barui *et al*. (2015) [19], a lower serum cholesterol level may have an impact on the ovaries' ability to synthesise steroids, which is linked to subnormal E_2 levels in RB animals as opposed to healthy cyclic animals. Correspondingly, Kumar *et al*. (2009) [14] reported the total cholesterol concentration in repeat breeder 214.12 cows vs normal cyclic cows 310.74. Also, Sabasthin *et al*. (2012) [8] recorded the cholesterol concentration in repeat breeder (83.70) cows vs normal cyclic cows (116.60).

Blood Urea Nitrogen (mg/dL)

BUN concentration was higher in G I (R) as compared to GII (N). Results were in agreement with the results of Dhoble *et al*. (2004) [20], Anushma *et al*. (2021) [21] in cows and Chaudhari *et al*. (2019) [22] in buffaloes. To agree with the present results, Widayati *et al* (2018) [11] reported that BUN concentration was significantly lower in fertile cyclic (16.97±2.55) cows than repeat breeder (27.60±4.25). Similarly, Cetin *et al*. (2002) [12] reported that lower urea concentration (32.43) in fertile cyclic cows Vs in repeat breeder cows (35.13). According to Barson *et al*. (2019) [23], RB cows had a mean BUN (mg/dl) of 25.05 mg/dL, which was significantly higher than the mean BUN (mg/dl) of normally cyclic cows (22.71 mg/dL). On contrary, Sabasthin *et al*. (2012) [8] reported the urea concentration in repeat breeder (18.0) cows vs normal cyclic cows (24.0).

Creatinine (mg/dL)

Serum creatinine levels were within the reference range of cows. However, Cetin *et al*. (2002) [12] reported that higher creatinine concentration (1.04) in repeat breeder cows Vs (1.0) in fertile cyclic cows.

Calcium (mg/dL)

Serum Ca concentration was higher in G II (N) than G I (R). To agree with the present results, Kumar *et al*. (2009) [14] reported the Ca concentration in repeat breeder (8.87) cows was lower than normal cyclic cows (10.3). Similarly, Chandrahar *et al*. (2003) [6] reported that the Ca concentration (mg%) was ranged from 5.29-7.05 with an average of 6.17 in normal fertile cows as compared to 6.6-12.94 with an average of 9.63 in repeat breeder cows. Likewise, Thasmi *et al*. (2020) [24] reported that Ca concentration in normal (9.07) as compared to repeat breeder (9.90) mg/dL in Aceh cows. In an another study, Amle *et al*. (2014) [9] reported that Ca concentration in normal cyclic crossbred cows (10.39) as compared to repeat breeder cows (8.49).

Phosphrous (mg/dL)

Serum P concentration was higher in G I (P) than G II (N). to accord with the present study, Kumar *et al*. (2009) [14] reported that P concentration in repeat breeder (8.80) cows Vs normal cyclic cows (7.26). on contrary, Chandrahar *et al*. (2003) [6] reported that the Phosphorus concentration (mg%) was ranged from 4.43-4.83 with an average of 4.6 in normal fertile cows as compared to 3.48-4.40 with an average of 3.98 in repeat breeder cows. Amle *et al*. 2014 [9] reported that inorganic Phosphorus concentration in normal cyclic crossbred cows (5.40) as compared to repeat breeder cows (4.44).

Conclusion

The serum total protein, albumin, globulin, glucose, creatinine concentration was significantly higher in normal cyclic Jersey crossbred cows as compared to repeat breeder group. But, the concentration of total cholesterol and BUN were higher in repeat breeder as compared to normal cyclic Jersey crossbred cows. As for as serum mineral, Ca concentration was significantly higher in normal cyclic group as compared to repeat breeder. However, the serum P was non significantly higher in repeat breeder as compared to normal cyclic group. These serum biochemical constituents might have a vital role in the physiological cyclicity of these cows, and these essential nutrients could be added to avoid repeat breeder syndrome in Jersey crossbred cows.

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References

1. Singh M, Pant HC. Factors associated with repeat breeding in Himachal Pradesh. Indian Vet J. 1999;76:522-523.
2. Parkinson TJ. Infertility in the cow. In: Arthur's Veterinary Reproduction and Obstetrics. Noakes DE, Parkinson TJ, England GCW, eds. 8th ed. W.B. Saunders Company; 2001:383-472.
3. Patel SB, Hadiya KK, Chavan DB. Incidence of reproductive disorders in cattle and buffaloes in Kaira district of Gujarat. Indian J of Field Veterinarians. 2007;3:15-17.
4. Purohit GN. Recent development of in the diagnosis and therapy of repeat breeding cows and buffaloes. CAB Rev Perspect Agricul Vet Sci Nutr Natur Res. 2008;3(62):1-33.
5. Malik MH, Verma HK, Sharma RK. Prevalence, risk factors and constraints in control of repeat breeding in dairy animals of Punjab. Indian J Anim Sci. 2019;89(8):837-842.
6. Chandrakar D, Tiwari RP, Awasthi MK, Hirpurkar SD. Indian J Anim Reprod. 2003;24(2):125-127.
7. Mondal MK, Paul SK. Haemato-Biochemical profile in Repeat Breeding Cross-Bred Cows. Explor Anim Med Res. 2012;2(1):60-65.
8. Sabasthin A, Kumar GV, Nandi S, Virupakshaiah. Blood haematological and biochemical parameters in normal cycling, pregnant and repeat breeding buffaloes (*Bubalus bubalis*) maintained in isothermic and isonutritional conditions. Asian Pacific J of Rep. 2012;1(2):117-119.
9. Amle M, Patodkar V, Shelar R, Birade H. Serum Biochemical Levels of Repeat Breeder Cross Bred Cows under Rural Condition of Satara District of Maharashtra. International J of Advanced Vet Sci and Tech. 2014;3(1):109-113.
10. Kekan PM, Shirbhate. Biochemical status during oestrus cycle in regular and repeat breeding cows. Theriogenology Insight - An International Journal of Reproduction in all Animals. 2015;(5):3:213-217.
11. Widayati DT, Bintara S, Natawihardja I, Maharani D. Blood biochemical profile in fertile and repeat breeder ongole cross breed cows. Pak J Biol Sci. 2018;21:166-170.
12. Cetin M, Dogan I, Polat U, Yalcin A, Turkyilmaz O. Blood biochemical Parameters in fertile and repeat breeder cows. Indian J Anim Sci. 2002;72(10):865-866.
13. Ahmed ME, Ahmed FO, Frah EAM, Elfaki I. Blood biochemical profile of Sudanese crossbred repeat breeder cows. African J Biot. 2017;16(8):366-370.
14. Kumar R, Butani MG, Dhami AJ, Kavani FS, Shah RG. Effect of different Therapies on Fertility and Serum Progesterone, Metabolites and Minerals Profile in Repeat Breeding Crossbred Cows. Indian J Field Vet. 2009;5(2):1-8.
15. Khan S, Thangavel A, Selvasubramaniam S. Blood biochemical profiles in repeat breeding dairy cows. Tamil Nadu J Vet Anim Sci. 2010;6:75-80.
16. Ahmed I, Lodhi LA, Quershi ZI, Younis M. Studies on blood glucose, total proteins, urea and cholesterol levels in cyclic, noncyclic and endometritic cross bred cows. Pakistan Vet J. 2004;24:92-94.
17. Mukherjee E, Carroll R, Matfin G. Endocrine and metabolic emergencies: hypoglycaemia. Therapeutic Adv in End and Met. 2011;2(2):81-93.
18. Jani RG, Prajapati BR, Dave MR. Hematological and biochemical changes in normal fertile and infertile Surti buffalo heifers. Indian J Anim Rep. 1995;5:14-22.
19. Barui A, Batabyal S, Ghosh S, Saha D, Chattopadhyay S. Plasma mineral profiles and hormonal activities of normal cycling and repeat breeding crossbred cows: A comparative study. Vet World. 2015;8(1):42-45.
20. Dhoble RB, Sharma NC. Serum phosphatase and transference enzymes in normal cycling and repeat breeder cattle. Indian J Anim Reprod. 2000;21:16-18.
21. Anushma, Kumar P, Singh M, Sharma A. Hematobiochemical and mineral profile evaluation in post-partum anestrus cows. Intas Polivet. 2021(II):374-376.
22. Chaudhari NF, Khasatiya CT, Modi LC, Chaudhari CF, Sharma HC, Patel JM. Comparative Studies on certain hormonal and biochemical profiles of normal cyclic and anestrus Surti buffaloes. Haryana Vet. 2019;58:43-45.
23. Barson RK, Padder S, Sayam ASM, Rahman MM, Bhuiyan MMU, Bhattacharjee J. Comparison of serum glucose, urea nitrogen, cholesterol, and total proteins in crossbred repeat breeder and normally cyclic cows. J Adv Vet Anim Res. 2019;6(1):82-85.
24. Thasmi CN, Husnurrijal H, Akmal M, Wahyuni S, Siregar TN. Detection of serum macro minerals concentration in repeat breeding aceh cattle. Jurnal Kedokteran Hewan. 2020;14(2):25-28.