

ASSESSMENT OF SERUM MINERAL PROFILE AT DIFFERENT STAGES OF GESTATION IN TRIPLE CROSSBRED CATTLE

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A study conducted on forty four triple cross-bred ($\frac{1}{2}$ Kankrej X $\frac{1}{4}$ Jersey X $\frac{1}{4}$ Holstein Friesian) pregnant heifers (20) and cows (24) on days 90, 150, 210 and 275 of gestation for various serum mineral parameters, revealed serum minerals calcium and phosphorus were significantly ($P < 0.01$) decreased from day 90 to day 275 of gestation and serum Ca : P ratio significantly ($P < 0.01$) rose from day 90 to day 275 of gestation. Overall combined value for serum sodium and potassium were significantly ($P < 0.05$) higher at day 275 as compare to day 90 of gestation.

Key words: Calcium, Gestation, Phosphorus, Potassium, Sodium, Triple cross

Minerals and electrolytes are important for normal body growth, reproduction and health of the animals. Their distribution and status varies with different physiological conditions viz. at fetal period, pre-pubertal period, pubertal period, maturity, estrus cycle, different stages of gestation and during lactation (Manoshi et al., 2000).

Calcium ion regulates a number of important physiological and biochemical processes including neuro-muscular excitability, blood coagulation, secretory process, membrane integrity, enzyme reactions and release of hormones. Phosphorus is essential for many intracellular processes, notably glycolysis, membrane maintenance, oxygen transport, muscle contraction and protection from

oxidative damage (Kahn, 2005). Changes in the levels of various serum electrolytes of cows in pregnancy, parturition and lactation have been studied earlier (Gibasiewicz, 1985; Ulutas et al., 2003).

Pregnancy represents the physiological condition in which the nutritional requirement of the mother becomes greatly intensified since the fetus is dependent on the mother and she has to mobilize nutrients from her tissues for meeting the extra intra uterine fetal requirements (Abrams, 2007 and Anonymous, 2010). Though, some information is available regarding the blood biochemical, hormonal and mineral status during different stages of pregnancy in some indigenous breeds of cattle and their crosses, however, not much information is available for triple cross bred cattle. To know the comparative biochemical parameters in cross bred cattle at various stages of gestation, the present investigation was planned during different periods of pregnancy in triple cross bred ($\frac{1}{2}$ Kankrej x $\frac{1}{4}$ Jersey x $\frac{1}{4}$ Holstein Friesian) cattle.

MATERIALS AND METHODS

Forty four normal and healthy, triple crossbred ($\frac{1}{2}$ Kankrej X $\frac{1}{4}$ Jersey X $\frac{1}{4}$ Holstein Friesian) pregnant heifers (20) and cows (24) maintained under standard management practices at the Livestock Research Station, Anand Agricultural University, Anand, Gujarat, India were utilized for the study. Pregnancy diagnosis was conducted per rectally during first week

of every month and the pregnant animals were closely monitored. Blood was collected through jugular venipuncture by aseptic measure after morning milking on days 90, 150, 210 and 275 of gestation. Clear serum was separated and stored at -20°C till further analyses. Serum calcium and phosphorous was estimated by Clark and Collip method (1925) and Fiske and Subbarow method (1925) respectively. Calcium : phosphorus ratio was calculated. Serum sodium and potassium was estimated by Flame photometer method as described by Hawk et al. (1954). Statistical analyses were done using unequal Completely Randomized Design (CRD) as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The mean \pm S.E. values of serum calcium, phosphorus, Ca:P ratio, sodium and potassium in triple cross cattle during the various stages of gestation are presented in Table 1.

Serum Calcium (Ca)

In both cows and heifers, a non significant increase was observed in serum calcium levels (mg/dl) on day 150 from its levels on day 90. The levels then dropped non significantly on day 210 and further decreased significantly ($P<0.01$) on day 275. A similar trend was observed in the overall combined values of cows and heifers. The highest levels were observed on day 150 and the lowest on day 275 of gestation, in both cows and heifers.

In the present investigation, it was observed that serum calcium levels increased during the early stage of pregnancy but the level declined significantly ($P<0.01$) at advanced pregnancy. This observation agreed with the findings of Sahukar et al. (1984), Rajora and Pachauri (1998) and Sivaraman et al. (2003) in various crossbred cows. Sivaraman et al. (2003) obtained higher calcium levels during 1st, 2nd and 3rd trimester of pregnancy than the values observed in this study. This may be attributed to breed variation. However, Rao et al. (1981), Sivaiah et al. (1986) and Dodamani et al. (2009) did not find any significant difference in serum calcium levels between early and late pregnancy in crossbred cows. However, Jacob et al.

(2002) showed an increasing tendency of the calcium level attained by the ninth month of pregnancy in crossbred heifers and their values were similar to those found in the present study.

The highest value of serum calcium recorded at 150 day of pregnancy in our study may be attributed to the increased demand of calcium for the development of fetal skeleton (Jacob et al., 2002) and colostrum formation (Horst et al., 2005). The decline in serum calcium during later stages of gestation may be due to increased estrogen levels which favours the deposition of calcium in the bone (Manzoor et al., 1994). Calcium plays a significant role in sensitizing the tubular genitalia for the action of hormones involved in parturition (Sangha et al., 1993).

Serum Phosphorus (Pi)

The serum phosphorus (mg/dl) levels during various stages of gestation in heifers, cows and overall combined values showed a decreasing trend as gestation advanced. The stage of gestation had a significant ($P<0.01$) effect on the levels of phosphorous in both the groups and the combined values.

A significantly decreasing trend of serum phosphorus from first trimester to the advanced pregnancy was also reported in Red Sindhi crossbred cows (Sahukar et al., 1984), Ongole crossbred cows (Sivaiah et al., 1986) and Deoni crossbred cow (Dodamani et al., 2009). The values reported by Sahukar et al. (1984) during first, seventh and ninth month of pregnancy were slightly lower than the values obtained in the present study. Rajora and Pachauri (1998) in pregnant lactating crossbred cows also reported a decreasing trend in phosphorus levels with advance pregnancy. However, the serum phosphorus concentration has been reported to show gradual increasing trend from early to advanced pregnancy by Rao et al. (1981) in Ongole cows, Jacob et al. (2002) in crossbred heifers and Sivaraman et al. (2003) in Jersey crossbred cows.

The decrease in serum phosphorus during pregnancy could be due to increased utilization of phosphorus at this stage with enhanced carbohydrate metabolism (Sahukar et al., 1984), to meet the requirement of

phosphorus for the secretion of colostrum (Rook and Thomas, 1983) and also for the requirement for fetal growth (Jacob et al., 2002).

Calcium : Phosphorus (Ca : P) ratio

The Ca : P ratio in heifers showed a non-significant increasing trend from day 90 to day 275 of gestation. However, in cows significant ($P<0.05$) increasing trend was observed. Similarly, significant ($P<0.01$) increasing trend from day 90 to day 275 was observed in overall values of Ca : P ratio.

Similar observation during pregnancy has been reported by Sivaiah et al. (1986) in Ongole crossbred cows. However Rajora and Pachauri (1998) found a significant ($P<0.05$) decreasing ratio of Ca : P from 1.53 ± 0.08 to 1.39 ± 1.51 in non-lactating pregnant cows to 1.45 ± 0.02 to 1.14 ± 0.01 in pregnant lactating cows.

Calcium and phosphorus ratio in diet is important for deciding the proper utilization of these two elements. The disturbed Ca to P ratio has a blocking action on the pituitary and consequently on ovarian action (Sikka, 1992) which may lead to infertility.

Serum Sodium (Na)

A definite significant ($P<0.05$) increasing trend of serum Na (mEq/L) was noticed in heifers. In cows, the values at day 275 was significantly ($P<0.05$) higher than that on day 90 and day 150 of gestation. A similar trend was also observed for the combined values of heifers and cows.

A similar trend of a gradual significant increase in serum sodium concentration was reported during the advanced pregnancy in Gir cows and its cross (Deshpande et al., 1998) and crossbred heifers (Jacob, 2000). But no definite trend in serum sodium levels was observed by Tainturier et al. (1984), Bahga and Singh (1992), Sivaraman et al. (2003) and Dodamani et al. (2009) in various breeds of cows and crossbreds.

The higher sodium level in the pregnant animal with an increasing trend as pregnancy advanced may be due to the accumulation of fluid in pregnant animals which is facilitated by reabsorption of sodium from the renal tubules (Kumar et al., 2001) and also may be due to an increased demand of this element by the fetus (Deshpande et al., 1998).

Serum Potassium (K)

A non-significant increasing trend of serum K (mEq/L) level was noticed during the present investigation in both groups of triple crossbred cows and heifers. The combined overall values of cows and heifers at day 275 was significantly ($P<0.05$) higher than the values noted on day 90 and day 150 of gestation.

Our results were in line with the observations of Jacob (2000) in crossbred heifers and Sivaraman et al. (2003) in Jersey crossbred cows. However, certain workers (Tainturier et al., 1984; Bahga and Singh, 1992, Deshpande et al., 1998 and Dodamani et al., 2009) found non-significant difference in serum K levels during different stages of pregnancy.

The requirement of potassium has been found to be increasing during pregnancy (Sikka, 1992). This may be because potassium located mostly within cells is needed for maintenance of acid-base balance in the body and also for normal tissue protein synthesis calcium dependent-big potassium channel (Bk (ca) channel) in protein depleted animals during the advanced pregnancy, which may lead to uterine relaxation at the time of labor (Choudhury et al., 2011).

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