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COMPARATIVE BIOCHEMICAL AND MINERAL PROFILE OF FEMALE INDIAN DROMEDARIES DURING BREEDING SEASON

N. Saini, N. Singh, B.D. Kiradoo and K.M.L. Pathak
National Research Centre on Camel, Jorbeer, Bikaner 334001, Rajasthan, India

ABSTRACT

Blood biochemical and mineral profiles of 8 female dromedary camels (3 fertile, 5 non -fertile) were studied at fortnightly intervals during different breeding phases (prebreeding, breeding and after breeding) for at least 180 day in relation to fertility with feeding of cluster bean straw *ad- lib* and concentrate mixture containing 14% DCP and 70% TDN along with area-specific mineral mixture to fulfill the energy, protein and mineral requirements. The camels were bred by natural service and pregnancy was monitored by tail curling method and then by rectal palpation. No statistical difference was observed for all estimated parameters between 2 groups throughout breeding period except P which was significantly lower in fertile group than that of non-fertile camels. Except urea-N, Mg and Cu values, all parameters showed decreasing trend from their respective initial values at pre-breeding period. Significant decline of Na and Zn levels in non-fertile and K and Mn in both the groups were observed. The results suggest that female camels showing better fertility had slightly better Ca:P ratio, urea N as well as concentration of Cu and Mg compared to non-fertile camels at time of breeding.

Key words: Biochemical parameters, breeding season, dromedary camels, mineral profile

Fertility rate in camels are extremely low in comparison to other domestic animals due to delayed puberty, restricted breeding season and long inter-calving intervals thus posing a major constraint for sustainable camel production (Ismail, 1990). Reproductive performance of animals depends very much on interaction between hormonal and nutritional status of animals. Macro (protein and energy) and micro nutrients play a vital role in establishing the reproductive tract environment conducive to fertility (Schultz *et al*, 1971). The Ca, P, Mg, K, Cu and Zn concentration of reproductive tract secretions affect the viability of spermatozoa, ovary or zygote via its effect on cell metabolism (Hurley and Mutch, 1973).

In this regard, blood biochemical and mineral profiles during breeding season has great relevance to future fertility in domestic animals. Influence of macro and micro nutrients on reproduction has been extensively investigated in dairy animals but scanty information is available for camels. Therefore, the present experiment was conducted with the aim to study the variations of blood biochemical and mineral concentrations during breeding season and their ultimate effect on fertility in female dromedary camels.

Materials and Methods

The study was conducted on 8 dromedary female camels not conceived from last 1-2 years maintained at NRCC over a 6-month period from September 2007 to February 2008. The whole period was divided into 3 phases i.e. pre-breeding (Sept.-Nov.), breeding (first half of Dec.) and after breeding (Jan. – Feb.). Of these, 3 camels conceived in second week of December were considered in fertile group. Before the onset of experiment, the camels were dewormed for endo-parasites. The camels were also examined for absence of any reproductive problems by rectal palpation. No genital abnormality and discharge were observed. Ovaries were functional and tone of uterus was present. Normal follicles were present in both the ovaries. Two she-camels were having functional follicles only on right ovaries. All the animals were kept in semi-intensive system with feeding of cluster bean straw *ad-lib*. Concentrate mixture containing 24 parts of de-oiled rice bran, 19 parts of rice bran, 12 parts de-oiled mustard cake, 13.5 parts guar korma, maize 23.5 parts, molasses 5 part and salt 1 part (14% DCP and 70% TDN) with area -specific mineral mixture was given to animals to fulfill the energy and protein requirement of animals.

SEND REPRINT REQUEST TO N. SAINI email: nirmala.saini@rediffmail.com

Camels were subjected to repeated rectal examination for ovarian activity, uterus tone and presence of follicles. A teaser male camel was used to detect female camels for service. Service was given on the basis of size of follicle, i.e. 1 mm checked by rectal palpation. The camels were bred by natural service and pregnancy was monitored by tail curling method and then by rectal palpation. Three camels conceived in first service and first mating instead of 3 services given in previous years. Total protein (Biuret-colorimetric), phosphorus (Phosphomolybdate, UV), BUN (Berthelot enzymatic calorimetric) and albumin (Bromocresol green calorimetric) were estimated by using the Standard diagnostic Kits – Spinreact-Spain. Serum concentrations of Ca, Mg, Zn, Cu, Fe and Mn were determined by atomic absorption spectrophotometer by using the manual of ECIL 4141, Hyderabad, India. All the data were subjected to independent t-test among groups and ANOVA among different phases in each group by using SPSS 10.0 software.

Results and Discussion

The blood biochemical and macro-micro mineral profile from before breeding to after breeding in fertile and non-fertile camels are presented in Tables 1 & 2.

The metabolic profile of camels studied was almost similar except P, thereby no significant difference was observed between 2 groups throughout breeding seasons. The concentration of most of the parameters declined during subsequent breeding period from their initial values at pre-breeding phase. These changes may be attributed due to physiological influence but not to dietary origin as camels of both groups received same diet. Abdalla *et al* (1988) stated that mineral requirement vis-à-vis blood mineral profile varies with physiological status, season and health of animals. Since, all estimated blood biochemical and macro-micro minerals were within the normal range, this suggesting no perceptible nutritional deficiency due to inadequacy of diet.

The initial values of total protein and globulin in fertile camels were slightly higher (6.09±0.95 & 2.03±0.19 g%) than in non-fertile groups (5.76±0.54 & 1.69 ±0.10 g%). Thereafter, values in fertile group decreased significantly ($p<0.05$) at breeding and post breeding periods which may possibly be to meet the need of increased metabolism due to physiological stress. Similar to present study, a sharp decrease in concentration of globulin was also observed by Singh and Singh (2005) during fertile oestrous compared to non-fertile. The overall protein levels in fertile and infertile groups were 5.53±0.10 and 5.62±0.13 g%, respectively and did not differ significantly between groups. According to Patil and Deshpande (1979) concentration of total proteins is not related to exhibition of oestrous symptoms and thus fertility. However, the role of proteins in reproduction of farm animals is equivocal. An excess of proteins has been reported to cause a decrease in pH of uterine secretion (Elord and Butler, 1993) or diversion of energy from ovarian activity whereas, lower level of

Table 1. Mean (±SD) and ranges of serum biochemical profile of fertile and non-fertile camels during breeding season.

Parameters	Groups	Before breeding (Sept.-Nov.)	At breeding (First half of Dec.)	After breeding (Jan. -Feb.)	Pooled ±SE
Total protein (g%)	fertile	6.09±0.95 [b] (5.93-6.26)	5.42±0.42 [a] (5.35-5.49)	5.35 ±0.20 [a] (4.96-5.59)	5.62±0.13 (4.96 -6.26)
	infertile	5.76±0.54 (5.59 -5.90)	5.59±0.30 (4.73-6.32)	5.58±0.06 (5.38-5.80)	5.53±0.10 (4.73-6.32)
Total albumin (g%)	fertile	4.06 ±0.19 (3.80-4.43)	3.30±0.64 (2.03-4.05)	3.89±0.09 (3.35-4.12)	3.75±0.22 (2.03-4.43)
	infertile	4.06 ±0.06 (3.94-4.28)	3.93±0.25 (3.26-4.52)	3.90 ±0.07 (3.73-4.18)	3.96 ±0.08 (3.26-4.52)
Total globulin (g%)	fertile	2.03 ±0.19 [b] (1.65-2.32)	1.12 ±0.19 [a] (0.75-1.36)	1.52 ±0.13 [b] (1.35 -1.78)	1.56 ±0.15 (0.75-2.32)
	infertile	1.69 ±0.10 (1.32-1.92)	1.66 ±0.19 (1.30-1. 98)	1.67 ±0.11 (1.43 -2.07)	1.67 ±0.06 (1.30-2.07)
Urea-N (mg%)	fertile	10.47±0.18[A] (10.11-10.68)	22.18±1.65[B] (20.27-25.47)	10.92±1.21[A] (8.53-12.41)	14.52±2.00 (8.53-25.47)
	infertile	9.13±0.48[a] (8.02-10.51)	19.37±3.40[b] (10.52-30.04)	13.78±1.14[ab] (9.95-16.14)	14.08±1.58 (8.02-30.04)

Small and capital letters differs significantly at 0.05 and 0.01%

Table 2. Mean (±SD) and ranges of serum mineral profile of fertile and non fertile female camels during breeding season.

Parameters	Groups	Before breeding (Sept.-Nov.)	At breeding (First half of Dec.)	After breeding (Jan. -Feb.)	Pooled values
Calcium (mg%)	fertile	9.47±0.50 (8.64-10.37)	7.47±0.68 (6.10-8.22)	8.95±0.88 (7.75-10.69)	8.63±0.46 (6.10-10.69)
	Infertile	9.24±0.17 (8.78-9.79)	8.54±0.95 (5.68-11.50)	7.98±0.56 (6.30-9.27)	8.59±0.37 (5.68-11.50)
Inorganic Phosphorus (mg%)	fertile	4.87±0.13 (4.61-5.07)	4.44±0.51 (3.62-5.39)	$3.84±0.22^{B}$ (3.43-4.22)	4.38±0.22 (3.43-5.39)
	Infertile	4.93±0.16 (4.63-5.52)	4.99±0.33 (4.17-6.07)	$4.66±0.22^{A}$ (4.12-5.21)	4.86±0.14 (4.12-6.07)
Ca:P ratio	fertile	1.94±0.12 (1.70-2.09)	1.72±0.25 (1.41-2.24)	2.37±0.66 (1.84-3.12)	2.01±0.16 (1.41-3.12)
	Infertile	1.88±0.07 (1.63-2.05)	1.75±0.24 (1.05-2.37)	1.74±0.17 (1.26-2.25)	1.79±0.09 (1.05-2.37)
Magnesium (mg%)	fertile	3.38±.012 (3.36-3.41)	4.08±0.26 (3.76-4.61)	4.27±0.47 (36.25-52.00)	3.91±0.20 (3.36-5.20)
	Infertile	3.44±0.043 (3.33-3.55)	4.04±0.37 (3.36-5.35)	3.50±0.23 (2.72-4.17)	3.66±0.15 (2.72-5.30)
Sodium (meq/l)	fertile	143.41±4.34 (136.25-151.25)	125.0±0.76 (123.50-126.00)	146.33±8.41 (130-158.)	138.25±4.32 (123.50-158.00)
	Infertile	$147.15±1.14^{b}$ (144.5-151.25)	$123.0±4.64^{a}$ (110.0-136.50)	$148.20±7.89^{b}$ (120-165)	139.45±4.21 (110.0-165.00)
Potassium (meq/l)	fertile	$5.26±0.13^{b}$ (5.10-5.53)	$4.66±0.22^{b}$ (4.25-5.00)	$3.90±0.25^{a}$ (3.60-4.40)	4.61±0.22 (3.60-5.33)
	Infertile	$5.55±0.17^{B}$ (5.13-6.00)	$4.31±0.13^{A}$ (3.95-4.70)	$3.84±0.29^{A}$ (2.80-4.50)	4.56±0.22 (2.80-6.00)
Copper (ppm)	fertile	0.76±0.030 (0.73-0.83)	1.06±0.06 (1.00-1.20)	1.25±0.20 (0.95-1.65)	1.02±0.09 (0.73-1.65)
	Infertile	0.71±0.021 (0.65-0.78)	0.91±0.067 (0.70-1.05)	0.96±0.13 (0.50-1.25)	0.86±0.05 (0.50-1.25)
Zinc (ppm)	fertile	2.28±0.40 (1.66-3.05)	1.71±0.21 (1.35-2.10)	2.46±0.13 (2.20-2.65)	2.15±0.17 (1.35-3.05)
	Infertile	$1.96±0.058^{ab}$ (1.84-2.15)	$1.63±0.093^{a}$ (1.45-1.90)	$2.44±0.26^{b}$ (1.50-2.95)	2.01±0.12 (1.45-2.95)
Iron (ppm)	fertile	1.48±0.019 (1.45-1.52)	1.29±0.28 (0.94-1.85)	1.58±0.56 (1.48-1.65)	1.45±0.093 (0.94-1.85)
	Infertile	1.53±0.078 (1.35-1.79)	1.31±0.20 (0.84-2.04)	1.70±0.10 (1.31-1.87)	1.51±0.08 (0.84-2.04)
Manganese (ppm)	fertile	$1.24±0.10^{c}$ (1.05-1.40)	$0.35±0.05^{a}$ (0.30-0.45)	$0.66±0.08^{b}$ (0.50-0.80)	0.75±0.13 (0.30-1.40)
	Infertile	$1.29±0.10^{B}$ (1.05-1.60)	$0.50±0.12^{A}$ (0.20-0.95)	$0.54±0.069^{A}$ (0.35-0.70)	0.77±0.11 (0.20-1.60)

Small and capital letters differ significantly at 0.05 and 0.01%

serum proteins may cause deficiency of certain amino-acids required for the synthesis of gonadotropins (Vohra *et al*, 1995).

The blood urea–N was also estimated to assist in monitoring the protein status of breeding camels as urea-N in blood is directly related to dietary intake of proteins (Hammond, 1983). Urea-N increased significantly ($p<0.01$) at breeding and thereafter tended to decrease in both groups. The mean urea-N level in fertile and non-fertile groups was within critical range, i.e. 5-21 mg% (Kaneko *et al*, 1997). Further, Ferguson *et al* (1993) reported that conception rate decreased when BUN exceeded 20 mg/dl on the day of insemination. In this study, at the time of breeding urea-N in infertile

ranged from 10.52-30 mg/dl whereas in fertile group it was nearer to optimum range (20.22-25.47 mg/dl).

No statistical difference was noticed between the groups for all macro and micro minerals except P which was found to get decreased rapidly after conception in fertile group and was significantly lower (3.84 ± 0.22 mg%) than that of non-fertile group (4.66± 0.22 mg%) indicating increased demand of nutrients due to pregnancy stress and requirement of more supply of P by supplementation. Contrary to this, higher concentration of Ca, Mg, Mn and Cu were observed in fertile camels in comparison to non-fertile females.

The mean level of calcium, phosphorus and magnesium in fertile and non-fertile groups fluctuated insignificantly in different phases. Increased demand of Ca for pregnancy may be the reason of sudden fall in concentration of Ca in fertile camels only. Significantly low Ca in pregnant camels than non-pregnant was also reported by Khadjeh (1998). The mean Ca level in both groups (8.59±0.37 and 8.63±0.46 mg/dl) were within normal range of 8-10 mg% and difference between groups were non significant. Mean P level in both groups were at marginal level compared to suggested critical level of 4.5 mg/dl (Mc Dowell *et al*, 1993). Significant reduction in fertility and high number of service/ conception has been reported by Morrow (1969) in phosphorus deficient diet. However, Marinov (1978) reported no correlation between fertility and Ca and P level. Moreover, ratio of Ca: P (2:1) was found to be more important for their better utilisation from diet (Manston, 1966). The ratio observed was 1.79±0.09 in non fertile and 2.01±0.16 in fertile groups, thus indicating that animals having a ratio near to 2:1 have better chance of fertility.

Iron values noticed in present study were in suggested range (82 -190.3 µg/ml) and fluctuated non-significantly during breeding periods. Deficiency of iron has rarely been observed in grazing livestock due to its abundant availability in all natural feeds. The concentration of sodium and potassium in this present study during pre-breeding and after breeding were similar to those reported by Mohammad *et al* (2007). The overall Zn value in both groups was higher than the values reported by Mal *et al* (2001) in healthy camels. However, Sena *et al* (2007) reported a mean value 312.4 µg/dl in pregnant camels in last month of pregnancy.

During breeding, significant fall in concentration of Na ($p<0.01$) and Zn ($p<0.05$) in non fertile and K and Mn ($p<0.01$, $p<0.05$) in both the groups were observed. In contrast to this, serum Cu level showed increasing trend and were comparatively higher (1.02±0.09) in fertile group than infertile group (0.86 ±0.054) in the entire period of observation. Saxena and Gupta (1995) also found higher level of Cu in fertile cows than that of non fertile ones. The values of Cu reported by Faye *et al* (2005) in pregnant and non pregnant camels were 0.64 mg/l and 0.60 mg/l, respectively. Somewhat higher concentration of Cu at conception time thus serves as an indicator of presence of gonadal hormones in blood and involvement of copper in oestradiol – 17 Beta hormones. The association of copper with resumption of ovarian activity and fertility has also been reported by Manickam *et al* (1997).

Unlike the Cu, Mn showed inverse trend with significant fall during breeding time. Similar to present study negative relationship between plasma manganese and copper during oestrous period has also been reported by Singh and Singh (2005). Likewise Shah *et al* (2003) reported higher level of Cu (1.20±0.06 vs. 1.15±0.03) and lower concentration of Mn (0.057± 0.01 vs. 0.139±0.91 mg/ml) in fertile oestrous than non fertile. Low level of Mn at breeding might be due to that maximal Mn uptake occurred in corpora lutea between days 4 and 11 of oestrous cycle (Hidiroglou, 1979) and this suggesting that Mn is involved specifically in luteal metabolism and its deficiency may lead to failure of conception. The observed Mn values were lower than the required range i.e. <2.0 µg/ml. The values reported by Faye *et al* (2005) and Mal *et al* (2001) in healthy camels were slightly higher than the values recorded in present study.

Thus, the above study revealed almost similar values for most of the parameters throughout breeding season in fertile and non fertile camels. Alteration in metabolic profile occurred during breeding period showed that concentration of all estimated parameters except urea, Mg and Cu decreased in both the groups. Significant decline in concentration of total protein and globulin were observed in fertile than non fertile camels. Fertile she-camels also had optimum Ca:P ratio, urea N as well as comparatively high concentration of Cu and Mg than non fertile camels at the time of breeding.

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