Levofloxacin, a chiral fluorinated carboxyquinolone, is a recently developed fluoroquinolone often used as broad spectrum antibacterial agent for oral and intravenous administration in the management of bacterial complications in animals. The pharmacokinetics of levofloxacin has been investigated in a limited number of animal species including rabbits (Destache et al., 2001), cats (Albarellos et al., 2005), horse (Goudah et al., 2008), goats (Goudah and Abo el-sooud, 2008) and calves (Dumka and Srivastava, 2007). The present investigation was undertaken to determine the pharmacokinetics, urinary and milk excretion and dosage regimen of levofloxacin in the lactating goats following a single intravenous administration of 4 mg/kg b/w.

Materials and Methods

In the present study, five clinically healthy female lactating goats of non-descript breed between 20 and 24 months of age and 15 - 18 kg bw were used. All animals were kept under the same experimental conditions. The animals did not receive any drug treatment before the study. Levofloxacin (Tavanic - 0.5% Levofloxacin) was injected at the dose rate of 4 mg/kg bw into the jugular vein of all the goats. Blood samples (approx.2 ml) were withdrawn from the contralateral jugular vein into heparinized glass centrifuge tubes before and at 1, 2.5, 5, 7.5, 10, 15, 20, 30, 45 min and 1, 1.5, 2, 2.5, 3, 4, 6, 8, 10, 12, 16 and 24 h after administration of the drug. The samples of urine and milk were also collected at above noted time intervals and also at 30, 36 and 48 h. The concentrations of levofloxacin in plasma, urine and milk samples were estimated by a standard microbiological assay technique (Arret et al., 1971) using Escherichia coli (ATCC 25922) as the test organism. The disposition kinetic parameters were calculated manually by the computed least-squares linear regression technique (Gibaldi and Perrier, 1982).

Results and Discussion

Plasma levofloxacin disposition curves after intravenous administration were best fit to an open three compartment model in all the lactating goats, which was in accordance with results reported for danofloxacin and moxifloxacin in camels (Aliabadi et al., 2003). Levofloxacin was rapidly transferred from
central to peripheral compartment I in lactating goats as it was evident by high value of $\alpha_1 (7.62 \pm 0.32 \, \text{h}^{-1})$. Then it was gradually distributed in peripheral compartment II ($\alpha_2 = 0.92 \pm 0.25 \, \text{h}^{-1}$). This is reflected by a shorter half life of distribution phase I ($t_{1/2 \alpha_1} = 0.09 \pm 0.003 \, \text{h}$) than distribution phase II ($t_{1/2 \alpha_2} = 0.66 \pm 0.08 \, \text{h}$). The mean Vdss of levofloxacin in the present study was found to be $3.70 \pm 0.58 \, \text{L/kg}$ in lactating goats, indicating wide tissue distributions. These findings reflected marked capacity of levofloxacin to penetrate into biological membranes. The present finding was consistent with Vdss reported for enrofloxacin, orbifloxacin and marbofloxacin in horses (Davis et al., 2006). The higher value of $4.19 \pm 0.51$ obtained for approximate tissue to plasma concentration ($T \approx P$) ratio indicated very good distribution of the levofloxacin in the body of lactating goats.

The obtained AUC value in lactating goats ($5.49 \pm 0.44 \, \text{mg.h/mL}$) was consistent with that recorded in calves ($7.66 \, \text{mg.h/ml}$; Dumka and Srivastava, 2007) and reflected coverage of a vast body area by the drug concentration. The elimination half-life ($t_{1/2 \beta}$) of levofloxacin in lactating goats calculated in this study ($4.68 \pm 0.48 \, \text{h}$) was comparable to the $t_{1/2 \beta}$ of 3.64 h in goats (Goudah and Abo el-sooud, 2008) and 3.67 h reported for levofloxacin administered intramuscularly in calves (Dumka and Srivastava, loc. cit). The total body clearance ($\text{Cl}_B$) was $0.74 \pm 0.06 \, \text{L/kg/h}$.

The concentrations of levofloxacin in urine were observed to be much higher ($43 – 58$ times) than those of plasma and milk and could be detected in urine till 48 h post-injections. These findings suggested that levofloxacin might be the appropriate drug for treating urinary tract infections in goats.

Based on the results of the present study, the absolute dose of levofloxacin per day, was calculated to be $3.03 \, \text{mg/kg}$ followed by $2.77 \, \text{mg/kg}$ at 12 h intervals under field conditions.

References