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EFFECT OF SEASONAL DEHYDRATION ON CREATININE CLEARANCE IN INDIAN DROMEDARY CAMELS

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ABSTRACT

Effect of seasonal dehydration on creatinine clearance was determined on eight healthy female Indian dromedary camels ageing from 6 to 10 years. Dehydration period was of 24 days in winter season and 13 days in summer season. All animals were catheterised. The overall mean values of creatinine clearance were 582.41 ± 14.193 and 424.25 ± 10.45 ml/min during winter and summer controls, respectively. During winter and summer the mean values decreased significantly ($p \leq 0.05$) with the progression of rehydration phase. The decline in creatinine clearance was 72.99% on day 24 of winter dehydartion and 86.50% on day 12 of summer dehydration. Rehydration resulted in progressive increase in mean value during winter and summer where the normal levels were achieved on hour 96 of rehydration, respectively.

Key words: Camels, creatinine, dehydration, rehydration, summer, winter

Water retention is the remarkable ability of the camel particularly in the extreme hot climatic conditions. However, assessment of this ability is poorly understood. Further dehydration entirely changes the physiological mechanism related with water metabolism (Kataria, 2000). To Parry the extrapolation of scientific know-how of other species to camels it becomes important to divulge the facts about this species. Under field conditions the scarcity of water is very common particularly in semi arid and arid tracts. Dehydration greatly affects renal functions. Dehydration is not only due to inadequate water intake but also develops due to fluid losses during diarrhoea, haemorrhage etc. Therefore an understanding of renal mechanism involved during dehydration is significant for crisis management in these animals. The evaluation of different adaptive measures taken by the camels during water scarcity can be done experimentaly by restricting water for longer periods (Ziv *et al*, 1997). Renal handling of water can be best judged by determining glomerular filtration rate. The technique used should be simpler so that it can be used in clinical cases. Creatinine clearance is used as a measure of GFR in many species (Bovee and Joyce, 1979; Zatzman *et al*, 1982; Bickhrdt *et al*, 1996; Puri, 2001; Meena, 2002 and Charan, 2002). However, reports are fewer on this aspect in camel (Schmidt-Nielsen *et al*, 1957 and Yagil and Berlyne, 1977) particularly during water restriction. In view of this an attempt was made to study the effect of seasonal dehydration on creatinine clearance in Indian dromedary camels.

Materials and methods

Experimental design

Effect of seasonal dehydration on creatinine clearance was determined on 8 apparently healthy adult female dromedary camels ageing 6 to 10 years of age belonging to National Research Centre on Camel, Bikaner, India. The seasons were winter (Range of mean minimum temperature was from 1.2 to 9.9°C) and summer (Range of mean maximum temperature was from 41 to 48.5°C). The same animals were used in both the seasons. Each animal served as its own control. During the experimental period the animals were kept in

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the pens and fed with sole roughage diet of dry chaffed *Phaseolus aconitifolius* plants and watered *ad libitum*. In each season the experiment was divided into control, dehydration and rehydration phases. The control phase in each season was comprised of 10 days. During this phase the animals were fed and watered *ad libitum*. The dehydration phase was of 24 days in winter and 13 days in summer. The animals were kept under same feeding and managemental conditions but with complete water restriction. The rehydration phase in each season was comprised of 5 days. After the end of dehydration phase water was provided *ad libitum* to each animal.

The creatinine clearance (Ccr) was carried out during the control phase; day 4, 8, 12, 16, 20 and 24 of dehydration and hour 12, 24, 48, 72 and 96 of rehydration in winter; and the control phase; day 3, 6, 9, 11 and 12 of dehydration and hour 12, 24, 48, 72 and 96 of rehydration in summer. Three creatinine clearance measurements were done in each case.

Technique

Ccr was determined as per the technique described by Coles (1986). The creatinine concentration in serum was estimated by the method of Folin and Wu (Oser, 1976) and in urine by alkaline picrate method as described by Varley (1967).

All the animals were catheterised (Kataria *et al*, 1999) to collect the urine samples. Catheter was disconnected from the urine bag and residual urine in the bladder was removed. Then the free end of catheter was put into a sterilised flask and time was noted. Then the next 20 minutes urine sample was collected into the flask. At the end of 20 minutes flask was removed and catheter was again connected to urine bag and a blood sample (at the end of 20 minutes) was obtained for serum. The total volume of urine obtained was measured and divided by 20 to get the rate of urine formation (ml/min). Creatinine concentration was determined in serum and urine samples. For every creatinine clearance measurement the same process was repeated.

Simultaneously the creatinine concentration was determined in the pooled urine samples (24 hours) to calculate the creatinine excreted in g/day, during control phase (winter and summer), on day 24 of winter dehydration and day 12 of summer dehydration and hour 96 of rehydration (winter and summer).

Calculation

$$\text{Ccr (ml/min)} = \frac{\text{Uc V}}{\text{Sc}}$$

Results and Discussion

Mean ± SEM values of creatinine clearance during different phases of study in winter and summer are presented in tables 1 and 2, respectively. The data of each component of creatinine clearance are presented as mean ± SEM of each collection period and as overall mean values. For each subset of the phase, there were three collection periods.

Ccr (ml/min) : The overall mean value of Ccr (ml/min) during winter was significantly ($p \leq 0.05$) higher than in summer, during the control phase a non significant ($p>0.05$) difference was there among mean values of collection periods for each subset. During winter and summer, the mean values decreased significantly ($p \leq 0.05$) with the progression of dehydration phase. The decline in Ccr was 72.99 % on day 24 of winter dehydartion and 86.50 % on day 12 of summer dehydration. Rehydration resulted in progressive increase in mean value during winter and summer, where the normal levels were achieved on hour 96 of rehydration, respectively.

Vu (ml/min) : The overall mean values differed nonsignificantly ($p > 0.05$) during winter and summer control phase. Advancement in dehydartion gradually decreased Vu in each seasons. It decreased by 78.29% in winter and 95.83% in summer, at the end of respective dehydration periods. Upon rehydration a gradual increase was there but mean values did not reach the original levels on hour 96 in both the seasons.

Scr (mg/dl) : The mean value of serum creatinine was significantly ($p \leq 0.05$) higher during summer than winter, when compared during control phase. Progression of dehydration tended to increase the values significantly ($p \leq 0.05$), with the greater extent in summer. Rehydration resulted in progressive decrease in the mean values in each season.

Ucr(mg/dl) : A non significant ($p>0.05$) seasonal difference was noticed in the

Table 1. Creatinine clearance in camels during different phases of dehydration and rehydration in winter (mean ± SEM, n=8).

S. No.	Main Effects	Collection Period	V_u ml/min	Scr, mg/dl	Ucr, mg/dl	Ccr, ml/min	Ccr, ml/min/ kg.B.wt
1	Control Phase	I	8.625 ±0.323	1.372 ±0.123	93.913 ±10.938	582.125 ±25.97	1.185 ±0.026
		II	8.75 ±0.25	0.376 ±0.118	92.483 ±12.039	575.125 ±24.035	1.172 ±0.020
		III	9.00 ±0.267	1.325 ±0.097	87.617 ±8.265	590.00 ±26.792	1.202 ±0.033
		Overall Ψ	8.791 ±0.159	1.357 ±0.062	91.338 ±5.838	582.41 ±14.193	1.186 ±0.015
2	Dehydration Phase 4 Days	I	6.375 ±0.182	1.775 ±0.133	83.629 ±2.958	309.50 ±19.746	0.695 ±0.033
		II	6.375 ±0.182	1.875 ±0.15	88.012 ±5.339	307.87 ±22.032	0.688 ±0.042
		III	6.25 ±0.163	1.825 ±0.138	89.131 ±3.521	314.00 ±20.529	0.703 ±0.033
		Overall Ψ	6.33 ±0.098	1.825 ±0.078	86.92 ±2.298	310.458[b] ±11.482	0.695 ±0.020
	8 Days	I	5.25 ±0.313	2.27 ±0.200	104.213 ±6.325	242.25 ±9.76	0.587 ±0.021
		II	5.50 ±0.188	2.35 ±0.201	100.699 ±5.99	238.875 ±9.894	0.580 ±0.021
		III	5.00 ±0.188	2.243 ±0.187	113.106 ±9.258	253.625 ±12.075	0.616 ±0.025
		Overall Ψ	5.25 ±0.137	2.289 ±0.108	106.006 ±4.193	244.916[b] ±6.01	0.594 ±0.013
	12 Days	I	4.375 ±0.182	2.887 ±0.141	132.77 ±5.711	204.75 ±8.13	0.517 ±0.01
		II	4.375 ±0.182	2.937 ±0.114	137.683 ±4.90	205.00 ±7.19	0.526 ±0.012
		III	4.375 ±0.182	2.90 ±0.122	134.221 ±8.929	200.87 ±7.29	0.518 ±0.015
		Overall Ψ	4.375 ±0.100	2.90 ±0.070	134.891 ±3.744	203.541[b] ±4.186	0.520 ±0.0072
	16 Days	I	3.187 ±0.131	3.25 ±0.121	198.52 ±10.769	187.50 ±6.011	0.503 ±0.008
		II	3.375 ±0.182	3.325 ±0.104	188.101 ±12.264	187.50 ±6.27	0.502 ±0.008
		III	3.687 ±0.388	3.375 ±0.129	180.951 ±16.80	186.50 ±5.49	0.498 ±0.0081
		Overall Ψ	3.416 ±0.149	3.35 ±0.065	189.191 ±7.611	187.166[b] ±3.275	0.501 ±0.0046
	20 Days	I	2.375 ±0.182	3.875 ±0.160	290.88 ±15.846	174.625 ±6.10	0.488 ±0.006
		II	2.375 ±0.182	3.80 ±0.143	290.097 ±20.40	176.25 ±6.893	0.490 ±0.009
		III	2.875 ±0.125	3.737 ±0.159	228.582 ±14.635	173.625 ±4.992	0.486 ±0.0059
		Overall Ψ	2.541 ±0.103	3.804 ±0.086	269.854 ±11.246	174.83[b] ±3.34	0.488 ±0.004

mean values. As the dehydration period advanced, mean values increased significantly ($p \leq 0.05$) in both the seasons. Rehydration had a similar effect in each season on decreasing the mean values.

The decrease in Ccr during dehydration in the present study was due to the fact that rate of creatinine excretion was influenced by GFR and according to Coles (1986), any abnormality that decreases GFR will result in an increase in the serum creatinine concentration and reduced Ccr. Robinson *et al* (1974) suggested the excretion of creatinine as glomerular filtration dependent process. Yagil and Berlyne (1977) reported a decrease in creatinine clearance of 23% in dehydrated camels during spring and 72% in summer. The decrease was in accordance with the findings in the present study during winter dehydration, however, in the summer the decrease was higher.

In the present study the rise in Scr was 213.55 and 194.93% during winter and summer dehydrations, respectively. Yagil and Berlyne (1977) observed 60% increase in plasma creatinine in dehydrated camels, during summer. Increased concentration of Scr could be the outcome of decreased GFR and increased muscle break-

Table 1. Continues .....

S. No.	Main Effects	Collection Period	V_u ml/min	Scr, mg/dl	Ucr, mg/dl	Ccr, ml/min	Ccr, ml/min/ kg.B.wt
	24 Days	I	1.925 ±0.052	4.325 ±0.157	338.902 ±31.066	155.25 ±6.581	0.461 ±0.0081
		II	1.887 ±0.051	4.25 ±0.156	351.232 ±31.987	160.50 ±7.25	0.477 ±0.007
		III	1.912 ±0.071	4.192 ±0.140	347.366 ±26.900	156.125 ±6.525	0.466 ±0.014
		Overall Ψ	1.908 ±0.032	4.255 ±0.084	345.833 ±16.621	157.291^b ±3.77	0.468 ±0.0059
3	Dehydration Phase 12 Hrs.	I	2.325 ±0.160	2.627 ±0.170	246.953 ±39.123	204.75 ±11.544	0.497 ±0.021
		II	2.575 ±0.171	2.612 ±0.176	227.816 ±42.931	205.50 ±13.277	0.500 ±0.025
		III	2.262 ±0.137	2.562 ±0.155	243.241 ±33.102	204.75 ±10.445	0.498 ±0.020
		Overall Ψ	2.387 ±0.091	2.600 ±0.092	239.337 ±21.363	205.00^b ±6.517	0.498 ±0.012
	24 Hrs.	I	3.175 ±0.116	1.912 ±0.081	187.382 ±11.788	307.50 ±5.509	0.722 ±0.010
		II	3.437 ±0.175	1.872 ±0.133	171.886 ±15.862	308.875 ±5.77	0.727 ±0.011
		III	3.25 ±0.133	1.85 ±0.160	174.488 ±13.628	308.25 ±5.44	0.726 ±0.012
		Overall Ψ	3.287 ±0.082	1.878 ±0.071	177.91 ±7.77	308.208^b ±3.07	0.725 ±0.006
	48 Hrs.	I	3.625 ±0.156	1.785 ±0.059	179.633 ±5.324	363.25 ±8.101	0.837 ±0.0095
		II	3.4125 ±0.165	1.785 ±0.068	191.271 ±11.345	360.50 ±8.920	0.832 ±0.0092
		III	3.75 ±0.163	1.75 ±0.09	172.528 ±11.588	365.625 ±5.348	0.846 ±0.016
		Overall Ψ	3.595 ±0.093	1.773 ±0.041	181.144 ±5.67	363.125^b ±4.221	0.838 ±0.006
	72 Hrs.	I	4.70 ±0.121	1.693 ±0.104	154.357 ±11.080	426.25 ±11.420	0.967 ±0.008
		II	4.187 ±0.131	1.712 ±0.100	172.062 ±11.326	419.375 ±12.116	0.952 ±0.019
		III	4.875 ±0.125	1.625 ±0.104	144.762 ±11.456	431.125 ±12.766	0.977 ±0.0083
		Overall Ψ	4.581 ±0.992	1.677 ±0.057	157.060 ±6.659	425.583^b ±6.757	0.965 ±0.007
	96 Hrs.	I	5.317 ±0.249	1.718 ±0.066	183.467 ±15.679	556.75 ±32.382	1.243 ±0.042
		II	5.562 ±0.175	1.686 ±0.076	169.561 ±14.338	553.625 ±32.47	1.237 ±0.042
		III	5.25 ±0.25	1.637 ±0.082	179.164 ±17.310	560.125 ±32.57	1.253 ±0.042
		Overall Ψ	5.376 ±0.128	1.680 ±0.042	177.397 ±8.812	556.833^a ±17.92	1.245 ±0.023

Overall Ccr, ml/min have been compared from control means.

Means superscribed by letter 'a' does not differ significantly ($p>0.05$) and by letter `b' differ significantly ($p \leq$ from control means.

N = number of camels; n = number of observations; Ψ = n=24; Scr= serum creatinine;

Vu = rate of urine formation; Ucr= urine creatinine; Ccr= creatinine clearance;

Collection period = urine and plasma samples collected 3 times a day.

down during dehydration in camels. Coles (1986) described that any abnormality that decrease GFR would result in an increase in Scr. In the present study dehydration resulted in decreased GFR. According to McDonald (1980) cortisol causes the increased breakdown of muscle leading to muscle wasting and weakness. In last phase of dehydration the hidebound condition of camel was noted with severe weakness. Due to low GFR the daily excretion of creatinine was reduced.

To ascertain the use of Ccr in the determination of GFR, Ccr mean values should be compared with inulin clearance (Cin), which is an established technique for GFR.The Ccr mean value in the present study was compared with the inulin clearance (Kataria, 2000; Yagil and Berlyne, 1977) and found similar to Cin. This showed that Ccr can be used to determine GFR in camels. However, reports avilable on this aspect in dromedary camels are countable few. Schmidt-Nielsen *et al* (1957) reported endogenous true creati-nine clearance as a measure for GFR in camels. Creatinine is formed during muscle metabolism and excreted by glomerular filtration. The clearance of endo-genous creatinine and infused creatinine were found identical in dog

Table 2. Creatinine clearance in camels during different phases of dehydration and rehydration in summer (mean ± SEM, n=8).

S. No.	Main Effects	Collection Period	V_u ml/min	Scr, mg/dl	Ucr, mg/dl	Ccr, ml/min	Ccr, ml/min/ kg.B.wt
1	Control Phase	I	8.87 ±0.479	1.856 ±0.172	101.127 ±16.488	424.875 ±18.6	0.853 ±0.025
		II	9.875 ±0.295	1.781 ±0.136	75.183 ±6.928	415.875 ±21.60	0.833 ±0.032
		III	8.25 ±0.559	1.756 ±0.187	93.23 ±10.431	432.00 ±15.65	0.868 ±0.023
		Overall Ψ	9.00 ±0.288	1.797 ±0.092	89.85 ±6.97	424.25 ±10.45	0.852 ±0.015
2	Dehydration Phase 3 days	I	6.00 ±0.422	2.558 ±0.264	61.456 ±6.28	145.00 ±8.986	0.337 ±0.011
		II	5.125 ±0.440	2.77 ±0.231	77.781 ±8.451	140.6 ±9.31	0.327 ±0.015
		III	4.87 ±0.350	2.681 ±0.209	81.68 ±5.051	149.37 ±8.53	0.343 ±0.01
		Overall Ψ	5.33 ±0.245	2.669 ±0.131	73.63 ±4.144	144.99[b] ±4.99	0.336 ±0.007
	6 days	I	3.375 ±0.182	3.675 ±0.141	128.332 ±8.157	116.875 ±5.82	0.292 ±0.007
		II	3.25 ±0.313	3.661 ±0.131	146.27 ±20.839	117.578 ±5.74	0.297 ±0.01
		III	2.875 ±0.125	3.637 ±0.141	146.48 ±8.17	115.22 ±5.96	0.283 ±0.007
		Overall Ψ	3.166 ±0.13	3.657 ±0.076	140.363 ±7.793	116.55[b] ±3.232	0.291 ±0.094
	9 days	I	1.387 ±0.10	4.312 ±0.190	246.832 ±30.51	75.00 ±2.672	0.206 ±0.003
		II	1.312 ±0.083	4.57 ±0.276	271.42 ±25.71	75.75 ±2.234	0.202 ±0.006
		III	1.312 ±0.152	4.412 ±0.238	285.318 ±47.262	76.50 ±3.469	0.212 ±0.009
		Overall Ψ	1.337 ±0.065	4.433 ±0.133	267.857 ±19.978	75.75[b] ±1.571	0.207 ±0.003
	11 days	I	0.837 ±0.056	4.82 ±0.239	389.79 ±35.23	65.50 ±2.63	0.19 ±0.004
		II	0.887 ±0.081	5.00 ±0.224	409.581 ±64.03	66.37 ±3.54	0.183 ±0.007
		III	0.786 ±0.071	4.862 ±0.258	446.52 ±62.256	66.50 ±3.977	0.198 ±0.007
		Overall Ψ	0.837 ±0.039	4.89 ±0.133	415.298 ±30.96	66.125[b] ±1.894	0.190 ±0.003
	12 days	I	0.35 ±0.037	4.937 ±0.148	865.12 ±108.464	56.125 ±2.03	0.166 ±0.004
		II	0.40 ±0.068	5.45 ±0.234	924.843 ±149.56	56.86 ±3.05	0.167 ±0.007
		III	0.375 ±0.036	5.512 ±0.293	930.375 ±114.369	58.762 ±2.866	0.172 ±0.004
		Overall Ψ	0.375 ±0.027	5.30 ±0.139	906.78 ±69.48	57.25[b] ±1.502	0.168 ±0.003

(Shannon, 1937), rabbit and sheep (Pitts, 1968). Yagil and Berlyne (1977) compared the ETC clearance and inulin clearance in watered and dehydrated camels and found that at several periods tha ratio of Ccr : Cin approached unity. Bovee and Joyce (1979) also advocated the use of ETC clearance as a measure for GFR. Zatzman *et al* (1982) observed that no difference between Cin and Ccr in pony and horse. Bickhrdt and Dungelhoff (1994) found that Ccr in ewes was highly correlated with Cin. Bickhrdt *et al* (1996) noticed a highly significant correlation between Ccr and Cin in horses.

The creatinine excreted into urine as g/ day was also determined from the pooled urine samples and the mean values were 7.93 ± 0.452 and 5.53 ± 0.343 during winter and summer control; 3.08 ± 0.182 and 1.52 ± 0.114 on day 24 of winter and day 12 of summer dehydrations; 8.99 ± 0.513 and 6.12 ± 0.412 on hour 96 of winter and summer rehydrations, respectively. The urinary excretion of creatinine significantly ($p \leq 0.05$) decreased during dehydration and on hour 96 of rehydration exceeded the control level in both the seasons.

The mean values of creatinine excreted g/

Table 2. Continues .....

S. No.	Main Effects	Collection Period	V_u ml/min	Scr, mg/dl	Ucr, mg/dl	Ccr, ml/min	Ccr, ml/min/ kg.B.wt
3	Rehydration Phase 12 Hrs	I	0.85 ±0.15	4.35 ±0.327	406.57 ±64.67	72.625 ±0.943	0.182 ±0.016
		II	0.80 ±0.135	3.875 ±0.319	380.37 ±58.71	72.574 ±1.667	0.175 ±0.015
		III	0.85 ±0.119	3.925 ±0.249	361.14 ±46.51	74.27 ±1.34	0.185 ±0.015
		Overall Ψ	0.833 ±0.071	4.05 ±0.169	382.70 ±30.362	73.16[b] ±0.744	0.180 ±0.08
	24 Hrs	I	1.43 ±0.175	3.66 ±0.141	341.66 ±51.72	117.12 ±3.71	0.256 ±0.001
		II	1.55 ±0.154	3.637 ±0.212	306.149 ±41.57	119.50 ±7.091	0.265 ±0.013
		III	1.687 ±0.131	3.77 ±0.323	278.75 ±41.85	115.91 ±4.84	0.255 ±0.007
		Overall Ψ	1.558 ±0.088	3.691 ±0.131	308.854 ±25.561	117.512[b] ±2.997	0.258 ±0.005
	48 Hrs	I	2.937 ±0.199	2.725 ±0.298	194.51 ±22.60	194.25 ±12.49	0.442 ±0.011
		II	2.875 ±0.295	2.562 ±0.285	196.47 ±32.02	206.25 ±6.037	0.44 ±0.018
		III	3.00 ±0.163	2.562 ±0.252	154.567 ±9.961	208.37 ±4.72	0.45 ±0.011
		Overall Ψ	2.937 ±0.125	2.616 ±0.155	181.85 ±13.497	202.95[b] ±4.84	0.444 ±0.0079
	72 Hrs	I	5.375 ±0.182	2.337 ±0.133	125.83 ±11.137	285.25 ±8.34	0.61 ±0.005
		II	5.50 ±0.267	2.373 ±0.132	128.03 ±13.24	287.62 ±11.08	0.608 ±0.011
		III	5.25 ±0.313	2.37 ±0.111	136.171 ±16.64	287.25 ±9.75	0.616 ±0.010
		Overall Ψ	5.37 ±0.145	2.362 ±0.069	130.015 ±7.70	286.70[b] ±5.40	0.611 ±0.005
	96 Hrs	I	6.87 ±0.226	2.161 ±0.08	140.39 ±4.849	449.12 ±22.18	0.972 ±0.034
		II	7.5 ±0.267	2.22 ±0.086	131.39 ±4.67	444.00 ±18.53	0.961 ±0.031
		III	7.25 ±0.313	2.21 ±0.135	135.33 ±6.66	447.56 ±25.97	0.963 ±0.038
		Overall Ψ	7.20 ±0.159	2.199 ±0.058	135.70 ±3.11	446.89[a] ±12.38	0.965 ±0.019
	120 Hrs	I	8.37 ±0.26	2.13 ±0.04	113.13 ±6.04	441.25 ±20.99	0.95 ±0.03
		II	8.25 ±0.36	2.13 ±0.05	114.52 ±9.0	434.0 ±20.72	0.941 ±0.031
		III	8.625 ±0.263	2.225 ±0.09	119.58 ±8.70	457.93 ±23.28	0.985 ±0.023
		Overall Ψ	8.41 ±0.169	2.166 ±0.038	115.74 ±4.46	444.39[a] ±12.15	0.960 ±0.016

Overall Ccr, ml/min have been compared from control means.

Means superscribed by letter ‘a’ does not differ significantly ($p>0.05$) and by letter `b’ differ significantly (p ≤ from control means.

N = number of camels; n = number of observations; Ψ = n=24; Scr= serum creatinine; Vu = rate of urine formation; Ucr= urine creatinine; Ccr= creatinine clearance; Collection period = urine and plasma samples collected 3 times a day.

day in present study were in accordance with those given by Amer and Alhendi (1996) in camels. Kaneko (1989) showed closely related values for Ucr in cows (0.571 g/lit.) and sheep (0.4 g/lit.). Although the Ucr was higher in present study the total concentration of creatinine excreted as g/day was decreased in comparison to control levels. The progression of dehydration resulted in a rise in serum creatinine. This also indicated that Ccr did not depend upon GFR. Probably because of it dehydrated camels passed greater quantities of creatinine in lesser volume of urine thereby increasing Ucr on mg/dl basis. Since the GFR was badly affected in dehydrated camel, total excretion of creatinine decreased as compared with the control levels.

Conclusion

The results of present investigation clearly showed that endogenous creatinine clearance can be used effectively as a measure of glomerular filtration rate in camels as in other animals in place of inulin clearance. The mean values of creatinine clearance obtained in the present investigation were in accordance with that of inulin clearance. In the endogenous creatinine clearance there is no need to infuse any substance intravenously and determination of urine and serum creatinine is simple and therefore can be used in clinical cases.

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