CHAPTER IV

RESULTS

GROUP 1 : control animals

1.1. Effects of an oral administration of distilled water (10 ml/kg-bw) on general circulation and renal hemodynamics.

The distilled water was given into the stomach. The hemodynamic changes were compared between before and after feeding. The mean arterial blood pressure (MAP), heart rate (HR) and hematocrit (Hct) are given in table 1 and figure 3. They did not indicate the significant changes throughout the experimental period.

As shown in table 1, the results are expressed on mean $\pm$ SEM. The renal plasma flow (RPF) was decreased significantly from the mean control value before feeding approximately 17.25 %, 26.42 %, 39.08 %, 43.67 %, 43.13 %, 44.47 %, 44.74 % and 41.24 % in the experimental period from the half of hour to the end of experiment. The glomerular filtration rate (GFR) was tended to be low but not significance whereas the

filtration fraction (FF) was not any changes as shown in figure 4. However, the urine flow rate (V) was slightly increased insignificantly (figure 5), while the renal vascular resistance (RVR) was tended to be high from the first hour period to the end of experiment by approximately 49.87 %, 84.72 %, 103.7 %, 99.84 %, 103.45 %, 97.24 % and 93.79 %, respectively (figure 5).

1.2. Effect of an oral administration of distilled water on urinary electrolyte excretion and plasma concentration of electrolytes.

As shown in table 2 , figure 6 and 8 the urinary excretion rate of soduim ($U_{Na}V$) and chloride ($U_{Cl}V$) did not change after distilled water feeding. The fractional excretion of both (FE_{Na}, FE_{Cl}) was not altered, whereas the fractional excretion of potassium (FE_K) was increased significanlty in three to four hours post feeding from the control value of 17.83 $\pm$ 4.02 % to 28.92 $\pm$ 5.15 %, 35.22 $\pm$ 6.98 %, 45.59 $\pm$ 7.68 %. The significant increase in urinary excretion rate of potassium (U_KV) was seen from 0.24 $\pm$ 0.07 to 0.34 $\pm$ 0.10, 0.39 $\pm$ 0.11 and 0.42 $\pm$ 0.12 μEq/min/gm-kw, respectively (figure 7).

The plasma concentration of sodium, potassium and chloride were not altered significantly (figure 6,7,8 and table 2).

1.3. Effects of an oral administration of distilled water on osmolar clearance, plasma osmolality, urinary excretion rate and fractional excretion of osmolality and free water clearance

The osmolar clearance (C_{osm}) was transiently decreased after distilled water feeding and returned to control value at the end of experimental period as shown in table 3 and figure 10. The urinary excretion rate and fractional excretion rate of osmolality were not any changes throughout the experiment. The plasma osmolality (P_{osm}) was not altered as shown in figure 9. The free water clearance (C_{H_2O}) was tended to increase insignificantly from 1.60 $\pm$ 3.80 μl/min/gm-kw to 4.33 $\pm$ 3.19, 3.07 $\pm$ 2.84, 5.13 $\pm$ 1.85, 5.25 $\pm$ 2.06, 5.83 $\pm$ 2.16, 4.82 $\pm$ 2.18, 4.46 $\pm$ 2.80 and 4.23 $\pm$ 3.26 μl/min/gm-kw in half an hour to four hours after feeding respectively. It showed positive value all of experimental period.

GROUP 2 : the decoction of C. citratus (1.25 gm/kg)

2.1. Effects on general circulation and renal hemodynamics.

After feeding of decoction of C. citratus 1.25 gm/kg, mean arterial blood pressure , heart rate and hematocrit were not altered significanlty as shown in table 4 and figure 3. The renal plasma flow was slightly decreased but glomerular filtration rate was not different from the value before feeding, whereas the filtration fraction was slightly increased temporarily in 0.5 - 1.5 hours after feeding and then returned to control value (figure 4). The renal vascular resistance did not change significantly. Urine flow rate was tended to be low after feeding by approximately 21.91 %, 15.59 %, 27.72 %, 42.10 %, 35.99 %, 51.79 %, 51.34 % and 42.18 % but not significance as shown in table 4 and figure 5.

2.2. Effects on urinary electrolyte excretion and plasma concentration of electrolytes.

As shown in figure 6 and table 5, the significant decrease in fractional excretion of sodium was seen from 1.51 $\pm$ 0.38 % to 0.91 $\pm$ 0.39, 0.79 $\pm$ 0.27, 0.81 $\pm$ 0.24, 0.85 $\pm$ 0.23 % ($P < 0.05$).

The urinary sodium excretion rate was diminished from 1.13 ± 0.33 μEq/min/gm-kw to 0.68 ± 0.27, 0.61 ± 0.21, 0.59 ± 0.19 ($P < 0.05$), respectively. However, they did not change in 2.5 - 4 hr after feeding. The urinary excretion rate of potassium was tended to be high at the end of experimental period, while the urinary excretion rate of chloride was transiently decreased and tended to return control value at the end of experiment (figure 7 - 8). In addition, there were similar changes without statistical significance in fractional excretion and urinary excretion rate of potassium and chloride. Plasma concentration of sodium and chloride was not altered significantly as shown in table 5 and figure 6, 8. The plasma concentration and urinary excretion rate of potassium were tended to be high at the end of experimental period (figure 7).

2.3. Effects on plasma osmolality, urinary and fractional excretion of osmolality, osmolar clearance and free water clearance.

As shown in figure 9 and table 6, the urinary excretion rate of osmolality ($U_{osm}V$) was transiently decreased in 0.5 to 1 hour after feeding of 1.25 gm/kg decoction and then returned to control value. The

fractional excretion of osmolality (FE_{osm}) was significantly decreased in 0.5 and 2 hours after feeding and gradually returned to the mean control value without any change in plasma osmolality.

The osmolar clearance showed insignificant change throughout the experimental period of 1.25 gm/kg of decoction feeding, whereas free water clearance was tended to be low in 1.5 hour to the end of experiment. Despite without statistical significance, these changes were interesting (table 6 and figure 10).

GROUP 3 : the decodtion of C. citratus (2.5 gm/kg)

3.1. Effects on general circulation and renal hemodynamics.

As shown in table 7 and figure 3, mean arterial blood pressure and hematocrit were not significantly changed from the control values whereas heart rate was slightly decreased but not reached the statistically significant level. Urine flow rate was slightly diminished but not achieved the significant level (figure 5). After feeding, the glomerular filtration rate hardly differed from the control value though the renal plasma flow was transiently decreased in 0.5 to 2 hour periods and then

gradually increased near control value. On the other hand, the filtration fraction was temporarily increased in 0.5 - 1.5 hours after feeding without statistically significance (figure 4). The renal vascular resistance was elevated after 0.5 hour post-feeding throughout the end of experiment (figure 5).

3.2. Effects on urinary electrolyte excretion and plasma concentration of electrolytes.

As shown in table 8, figure 6 and 8, the urinary excretion rate of sodium and chloride was slightly decreased from the control value whereas the urinary excretion rate of potassium showed the insignificant increase (figure 7). The fractional excretion of electrolytes (Na, K, Cl) was altered accompany with the change of urinary excretion rate. However, their changes did not exhibit the statistical significance. As the plasma concentration of potassium was tended to be high but not significance (figure 7), the plasma concentration of sodium and chloride did not change from control values (table 9, figure 6 and 8).

3.3. Effects on plasma osmolality, urinary excretion rate and fractional excretion of osmolality, osmolar and free water clearance.

The plasma osmolality urinary excretion rate and fractional excretion of osmolality were not changed throughout the experimental period (figure 9).

The osmolar clearance and free water clearance after feeding of 2.5 gm/kg of decoction were not altered significantly in comparison to the control values. However, the free water clearance showed the negative values all of the experiment as shown in table 9 and figure 10.

GROUP 4 : the decoction of C. citratus (5 gm/kg)

4.1. Effects on general circulation and renal hemodynamics.

After bolus feeding of 5 gm/kg of decoction, the mean arterial blood pressure, heart rate and hematocrit did not modify from the value in control period (figure 3 and table 10). The urine flow rate

was slightly increased whereas the renal vascular resistance was minimal changed from the control value as shown in figure 5. The renal plasma flow was reduced in the first hour period of experiment, following that it almost returned to the mean control value at the end of experiment (figure 4). The glomerular filtration rate was not significantly altered. So the filtration fraction was slightly increased without the statistical significance (table 10 and figure 4).

4.2. Effects on urinary excretion and plasma concentration of electrolytes.

The urinary excretion rate of sodium was significantly decreased from 1.75 $\pm$ 0.16 to 0.87 $\pm$ 0.24 μEq/min/gm-kw and its fractional excretion was reduced from 2.33 $\pm$ 0.41 to 0.95 $\pm$ 0.22 % in the first hour of experimental period, respectively (figure 6). However, in the other periods of experiment, they did not change significantly from the mean control value. The urinary excretion rate and fractional excretion rate of potassium were increased in the 1.5 hour period to the end of experiment but not achieved the statistically significant level (figure 7). The urinary excretion rate and fractional excretion of chloride were slightly decreased in the first period but

not significance (table 11 and figure 8). Plasma concentration of sodium and chloride was not altered (figure 6 and 8), that of potassium was tended to be high from 3.39 ± 0.20 to 3.50 ± 0.25, 3.72 ± 0.16, 3.91 ± 0.27, 3.84 ± 0.27, 3.91 ± 0.23, 3.74 ± 0.18, 3.73 ± 0.11 and 3.68 ± 0.19 mEq/l despite no significance (table 11).

4.3. Effects on plasma osmolality, urinary excretion rate and fractional excretion of osmolality, osmolar and free water clearance.

Neither plasma osmolality, urinary excretion rate nor fractional excretion of osmolality were significantly changed after feeding of 5 gm/kg of decoction (figure 9 and table 12).

The osmolar clearance exhibited insignificant decrease in 0.5 to 1 hour after feeding of the decoction, following that its value was not altered as shown in table 12 and figure 10. The free water clearance showed negative values higher than control in 0.5 to 2 hours of experiment period and then its value gradually diminished near the control value. However, the changes of free water clearance were not achieved the statistical significance (figure 10 and table 12).

GROUP 5 : the decoction of C. citratus (10 gm/kg)

5.1. Effects on general circulation and renal hemodynamics.

As shown in figure 3 and table 13, high concentration of decoction was given into the stomach via gastric tube, it affected on general circulation as following, the mean arterial blood pressure was slightly elevated in 1.5 to 2.5 hours after feeding whereas heart rate showed the significant decrease in the same period ($P < 0.025$). The hematocrit was risen with the statistical significance throughout the experimental period from 29.4 ± 1.99 % to 31.2 ± 1.88, 32.6 ± 1.97, 33.4 ± 1.86, 34.2 ± 1.93, 35.0 ± 2.30, 34.8 ± 2.29, 34.8 ± 2.11 and 37.0 ± 2.42 %. The significant reduction of urine flow rate in the first two hour after feeding was demonstrated to 63.22, 72.28, 73.88 and 73.24 % , following that it continued to diminish by approximately 70.11, 72.28, 68.35 and 53.93 % without statistical significance (figure 5).

The renal plasma flow (RPF) was decreased ($P < 0.025$) throughout the experimental period from 2.99 ± 0.48 to 2.13 ± 0.43, 1.87 ± 0.41, 1.83 ± 0.48, 1.98 ± 0.52, 1.94 ± 0.45, 1.86 ± 0.35, 1.86 ± 0.36, 1.85 ± 0.41

ml/min/gm-kw as shown in table 13 and figure 4. The glomerular filtration rate had a significant decrease in 0.5 to 1 hour after feeding from 0.47 ± 0.11 ml/min/gm-kw to 0.22 ± 0.44, and 0.29 ± 0.07 ml/min/gm-kw, and then it was slightly decreased from the control value but not significant. The filtration fraction was diminished in 0.5 to 1 hour after feeding but not reached the statistically significant level, and then increased slightly significance (figure 4). The renal vascular resistance was elevated from the control period by approximately 48.09, 87.26, 127.78, 102.72, 104.38, 94.05, 83.94 and 68.56 %. However, it showed the significant change in some periods as shown in table 13 and figure 5.

5.2. Effects on urinary electrolyte excretion and plasma concentration of electrolytes.

Bolus feeding of high concentration of decoction had effected on urinary excretion of electrolyte. The urinary excretion rate of sodium was reduced from the mean control value of 1.33 ± 0.32 to 0.47 ± 0.26, 0.35 ± 0.24, 0.27 ± 0.16, 0.33 ± 0.21, 0.47 ± 0.24, 0.57 ± 0.27 and 0.62 ± 0.25 with the statistical significance, and it returned near the control value at the end of experimental period as shown in table 14 and figure 6.

The fractional excretion of sodium was changed similar to the urinary excretion rate (figure 6). The urinary excretion rate of potassium was significantly decreased in 0.5 to 1 hour after feeding and then returned to the control value at the third hour period after feeding, after that it was tended to be high but not significance. The fractional excretion of potassium was decreased from the control value in the period of 0.5 to 2 hour after feeding, however, this change was not significant. After 2.5 hour of feeding it was tended to be higher than the control value throughout the experiment (figure 7).

The significant decrease of urinary excretion rate of chloride was seen from 1.18 $\pm$ 0.33 to 0.25 $\pm$ 0.18, 0.19 $\pm$ 0.12, 0.17 $\pm$ 0.11, 0.25 $\pm$ 0.17 and 0.24 $\pm$ 0.13 μEq/min/gm-kw in the first hour period until the third hour period of experiment. Following that, it was tended to return to the control value as shown in table 14 and figure 8. The alteration of fractional excretion of chloride was similar to the urinary excretion rate. The significant decrease of fractional excretion of chloride was demonstrated at the second hour period of experiment (figure 8 and table 14).

The plasma concentration of sodium and chloride was increased but not reached the significant

level. The plasma concentration of potassium showed significant increase in the first hour to the 2.5 hour period of experiment, and then elevated continuously without significance until the end of experimental period (figure 6, 7, 8 and table 14).

5.3. Effects on plasma osmolality, urinary excretion rate and fractional excretion of osmolality, osmolar and free water clearance.

The osmolar clearance reduced significantly from the mean control value after high concentration of decoction feeding in 0.5 - 3 hours from 14.96 ± 3.24 to 5.15 ± 2.31, 5.75 ± 2.55, 5.26 ± 1.55, 6.59 ± 2.28, 7.95 ± 2.43 and 7.82 ± 2.45 μl/min/gm-kw, and then it returned to control value at the fourth hour period of experiment (figure 10 and table 15). Urinary excretion rate and fractional excretion of osmolality were exhibited the significant decrease in the first three hours after feeding of high concentration of decoction (10 gm/kg), and returned to the mean control value at the end of experiment (figure 9). The urinary excretion and fractional excretion of osmolality were diminished, while the plasma osmolality was not altered. However, the

free water clearance showed the negative values throughout the experiment. It was transiently increased in the first hour period and gradually decreased until the end of experiment as shown in table 15 and figure 10 but not reached the statistically significant level.

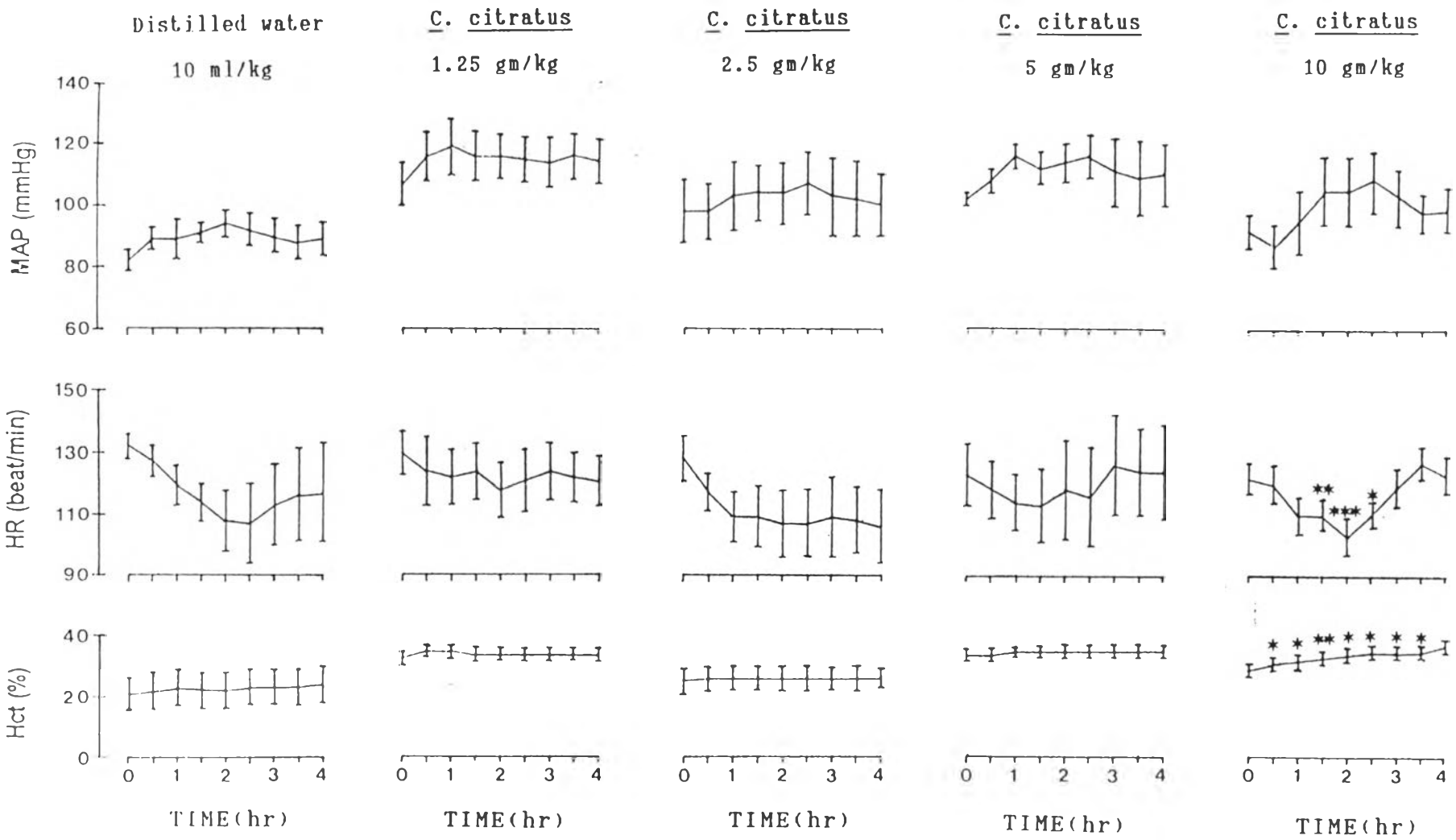

Figure 3 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on MAP, HR, Hct (n = 5) *P<0.05, **P<0.01, ***P < 0.005

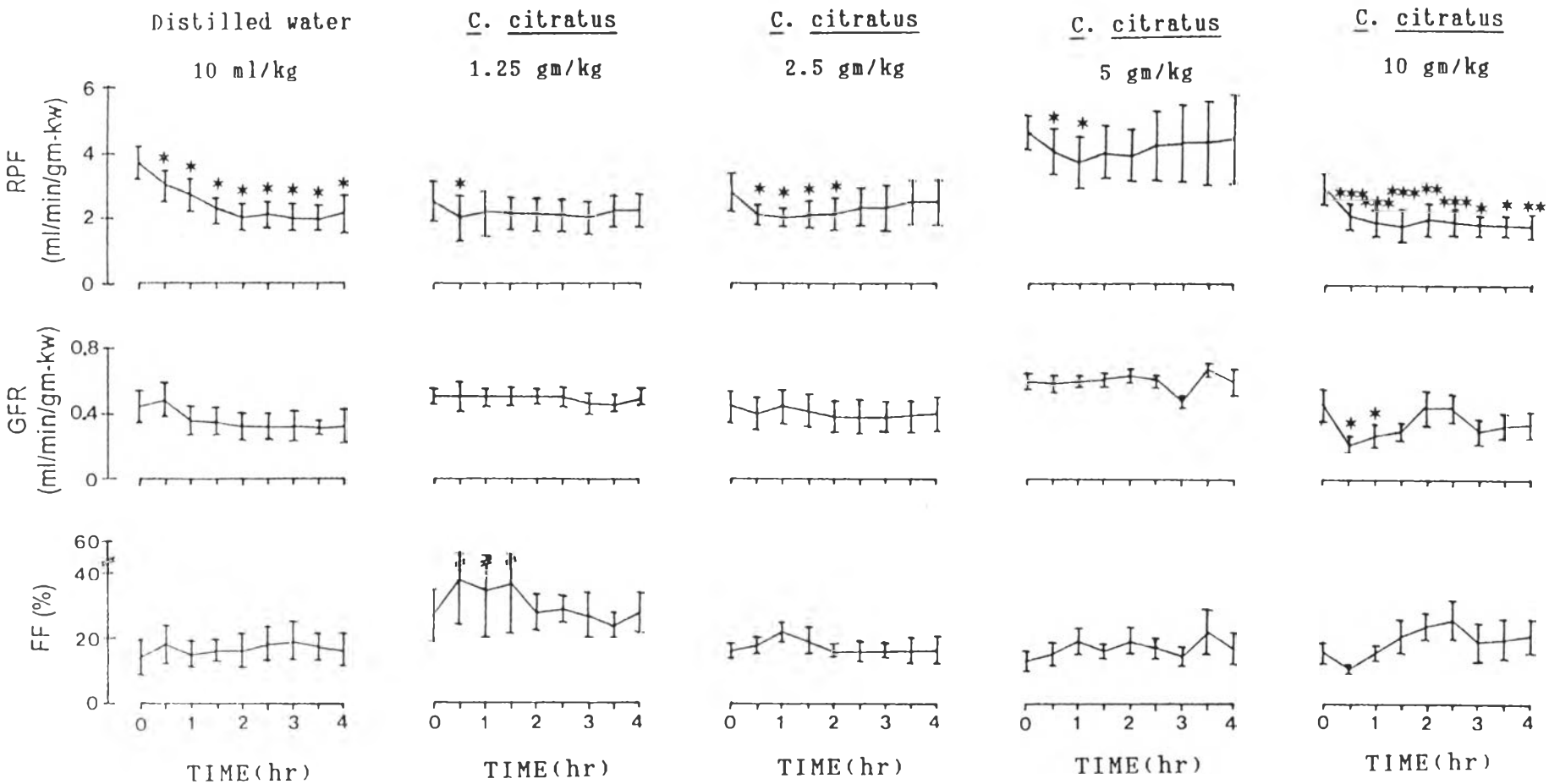

Figure 4 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on RPF, GFR, FF (n = 5) *P<0.05, **P<0.01, ***P<0.005

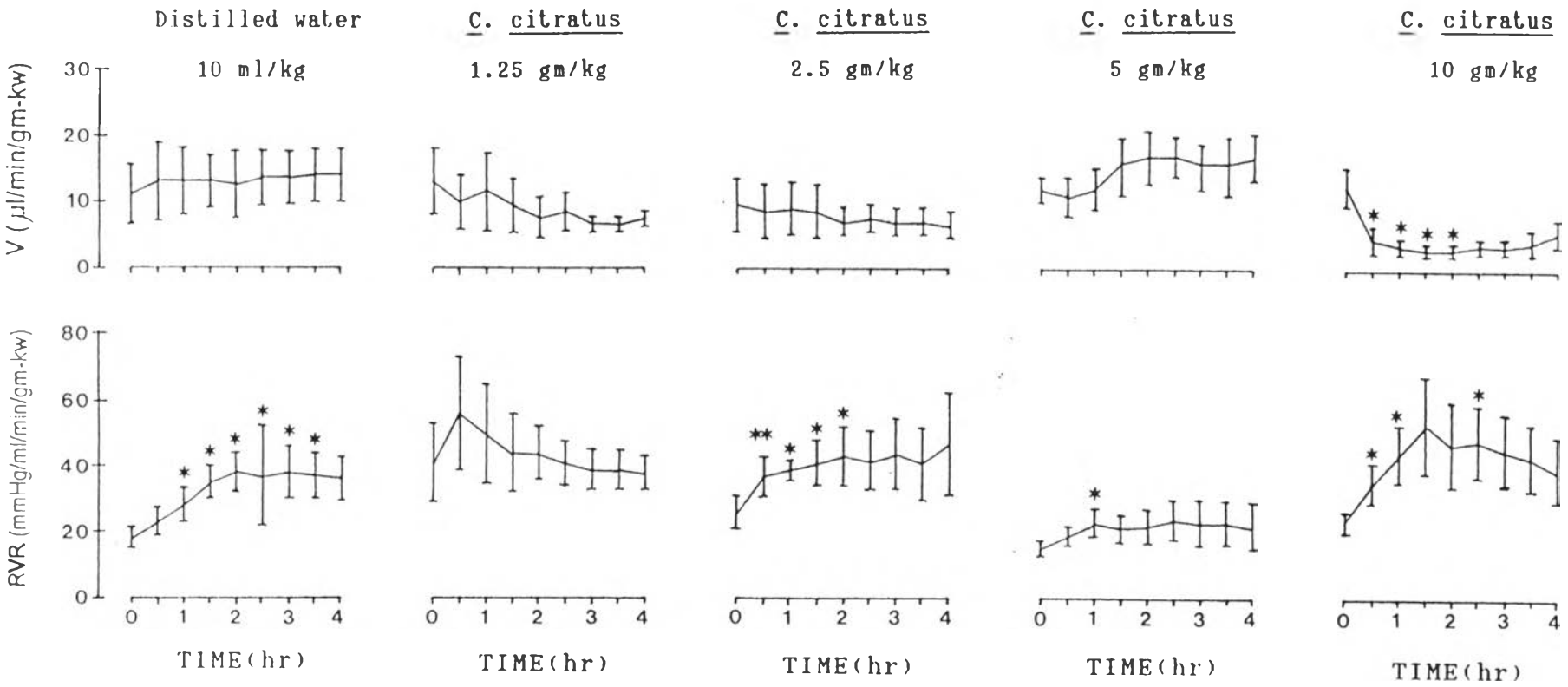

Figure 5 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on V and RVR (n = 5) *P<0.05, **P<0.01

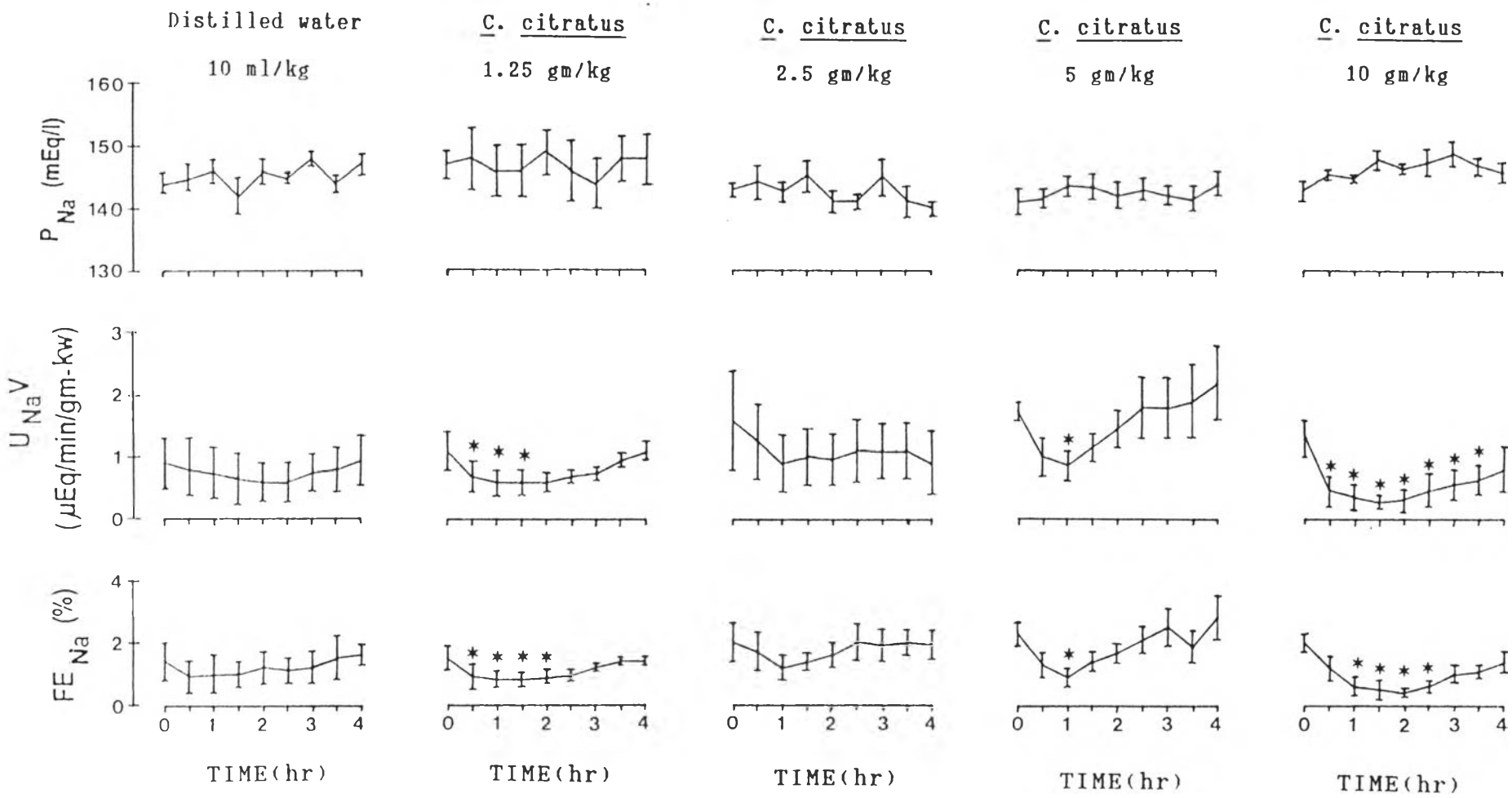

Figure 6 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on P_{Na}, $U_{Na}V$, FE_{Na} (n = 5) *P<0.05

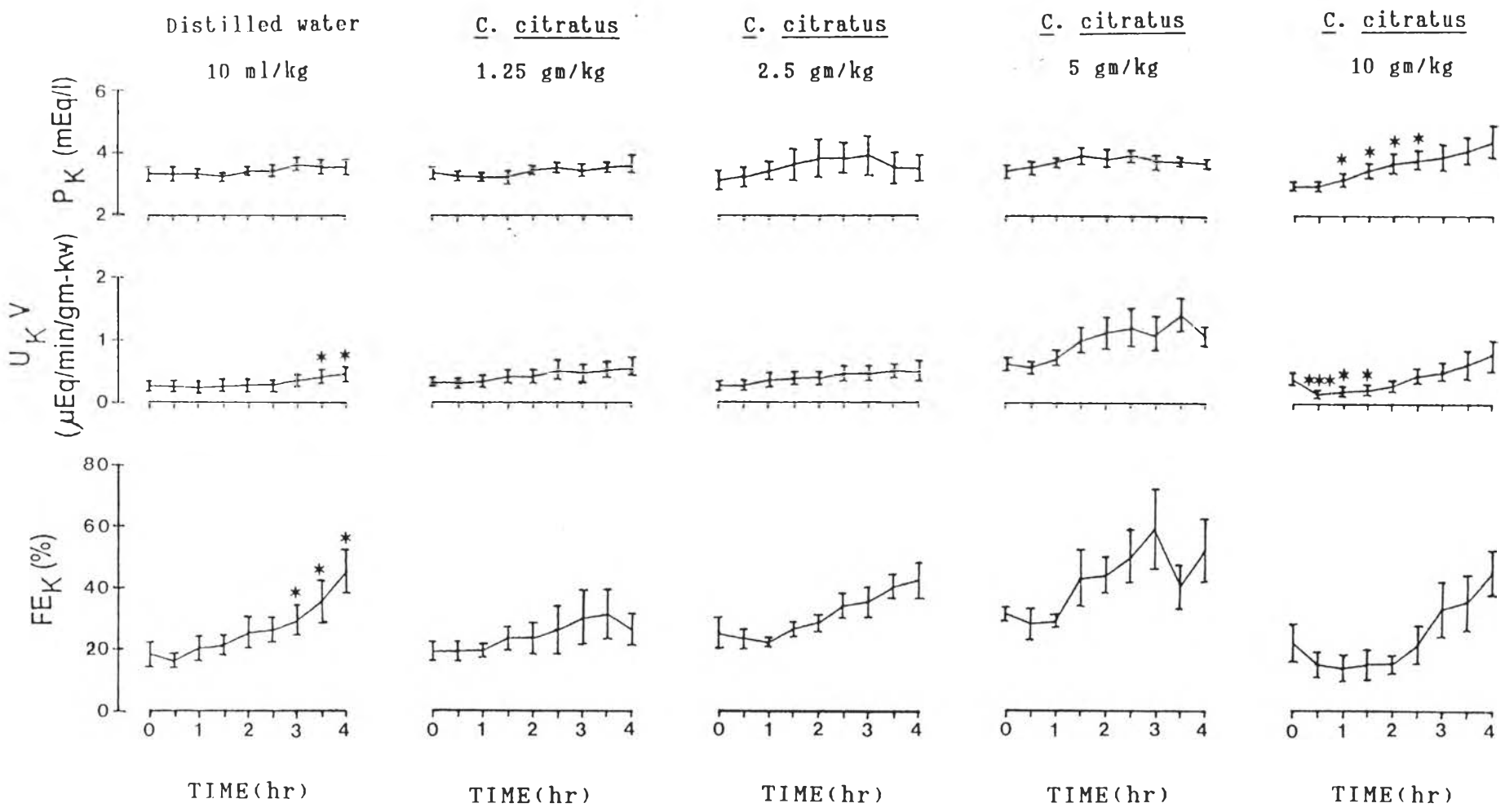

Figure 7 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on P_K, $U_K V$, FE_K (n = 5) *P<0.05, ***P < 0.005

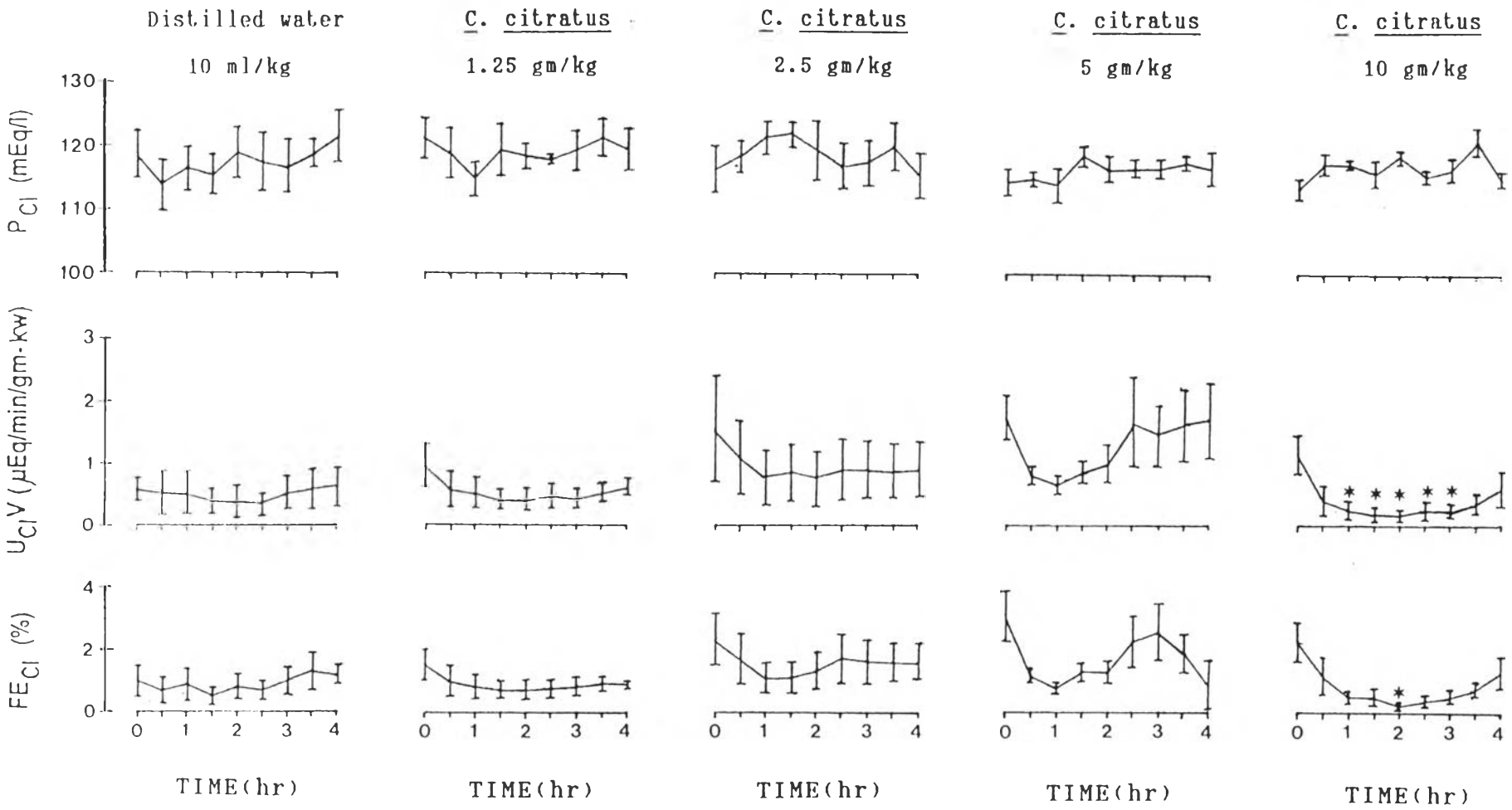

Figure 8 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on P_{c_l}, $U_{c_l}V$, FE_{c_l} (n = 5) *P<0.05

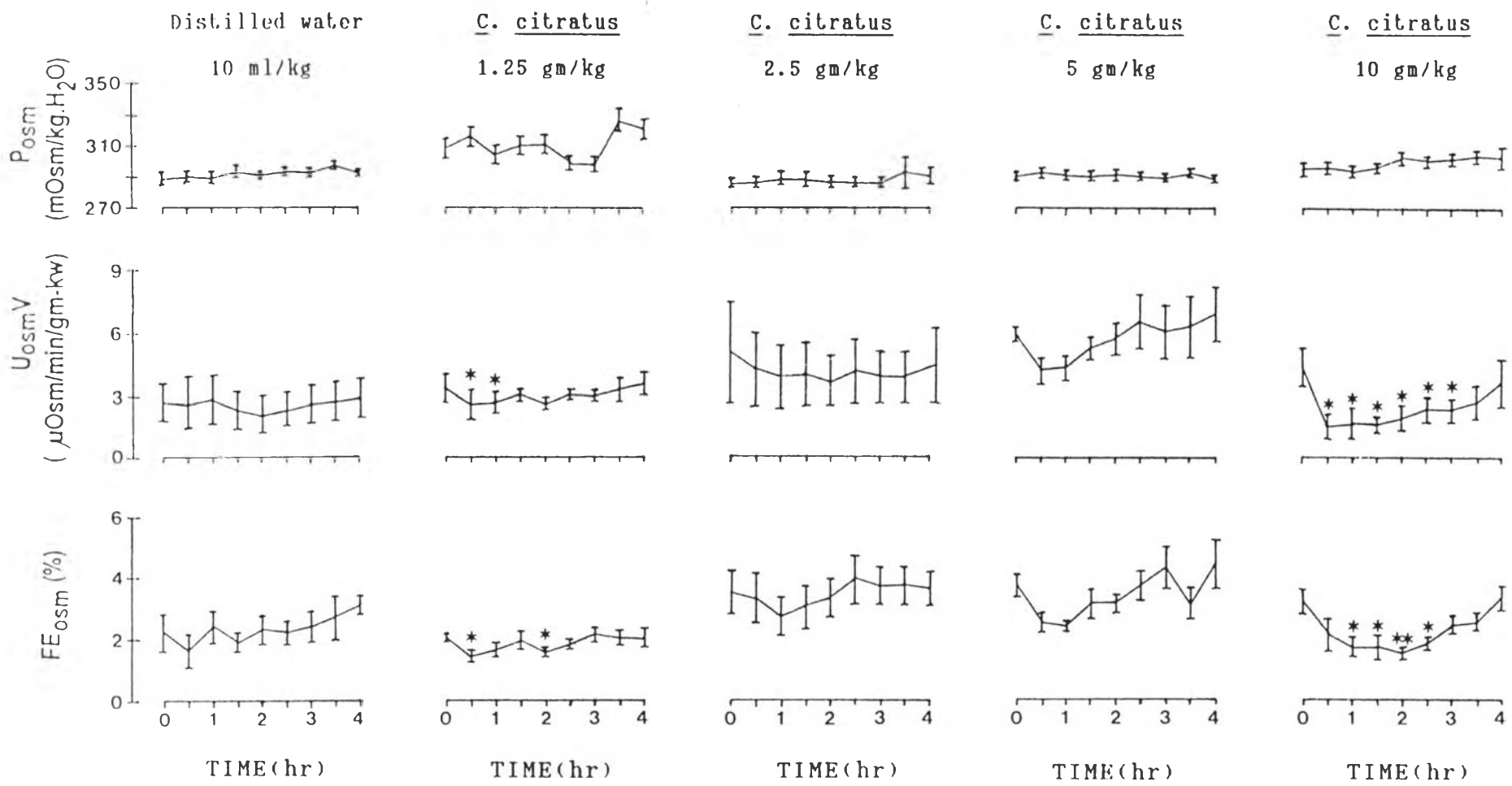

Figure 9 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on P_{osm}, $U_{osm}V$, FE_{osm} (n = 5) *P<0.05, **P<0.01

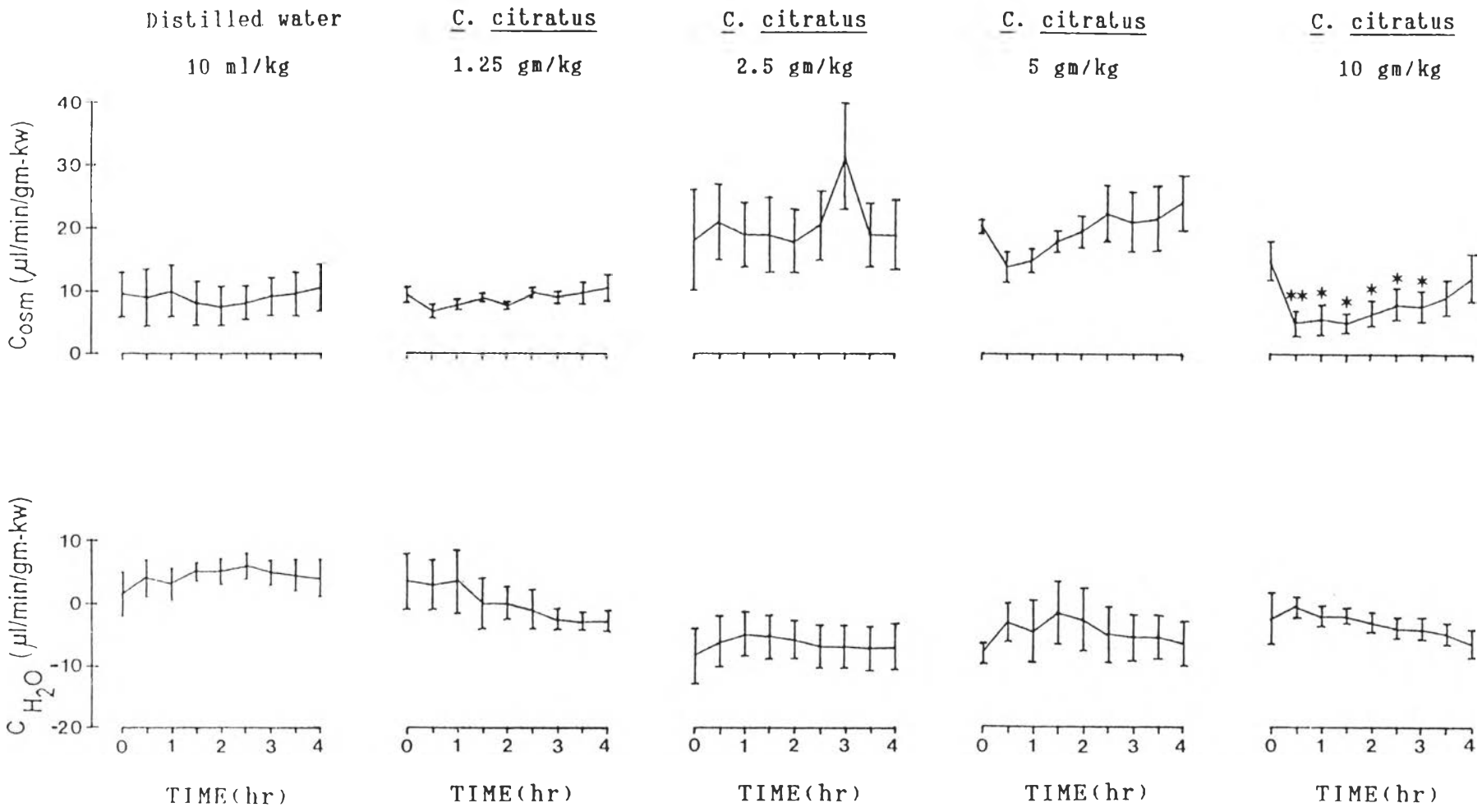

Figure 10 Effect of distilled water (10 ml/kg) and C. citratus (1.25, 2.5, 5 and 10 gm/kg) on C_{osm}, C_{H_2O} (n = 5) *P<0.05, **P<0.01