2. Title: Evaluation of Renal Function in Normal Thai Children

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Objectives: To define normal ranges of renal function in Thai children for anticipated studies of a variety of disease processes.

The study includes:

1. Diurnal variation and urinary excretion pattern of electrolytes, nitrogenous substance, calcium and phosphorus.

2. Concentration and dilution abilities

3. Glomerular filtration rate (Inulin, creatinine clearance) and renal plasma flow (PAH clearance)

4. Sweat composition

5. Plasma cholesterol, protein, osmolality, electrolytes, uric acid, Urea Nitrogen, creatinine calcium and phosphorus.

Description: Thirty six healthy children, 17 females and 19 males aged 6-12 years were studied at CRC. All subjects were put on normal diet and activity. Three consecutive days of two-period urine (7AM-7PM, 7PM-7AM) were collected and sent for urinary metabolites. Blood were collected each day at 1 PM, and 1 AM and sent for chemistry.

Inulin and PAH clearances were performed in an ordinary fashion with simultaneous creatinine clearances.

Concentration test was performed by using maximal concentration ability after 22 hours of water deprivation and injection of aqueous pitressin. Dilution ability was obtained after ingestion of water and alcohol.

Sweat test was obtained after application of heat.

Progress: Analysis of data revealed the following:

1. Total daily urinary excretion:

	No Subjects	Actual ± S.D.	per 1.73M² ± S.D.	Normal Adult* (Text)	Normal Thai Adult Sitprija et.al.**
Volume (ml)	35	1290 ± 424	2533 ± 812	700-3000	914 ± 6
Osmolality (Osm/L)	35	293 ± 86	—	600	517 ± 5.7
Osm./day	35	360 ± 101	722 ± 149	1200	446.7 ± 115.5
Na (mEq)	35	81.3 ± 49.8	167 ± 56	100-200	79.9 ± 7
K (mEq)	35	14.5 ± 5.01	30.6 ± 13.2	30-50	18.2 ± 3.9
Cl (mEq)	35	86.3 ± 28.2	177 ± 55	100-250	88.1 ± 21.3
Uric acid (mg)	33	342 ± 100	687 ± 164	290-750	—
Creatinine (mg)	35	399 ± 156	777 ± 157	300-1500	449 ± 90
Urea N_2 (Gm)	33	3.51 ± 1.14	6.99 ± 1.66	6-18	6.5 ± 0.9
Calcium (mg)	23	64.6 ± 31.0	140.3 ± 72.5	100-300	——
Phosphorus	23	243 ± 74.7	504 ± 118	700-1600	——
Creatinine clearance	35	—	90-8 ± 18.0	≠120 ml/min	61.2 ± 13

* From Hoffmann, White and King

** Sitprija et al, J.M.A.T. 48, 413, July 1965, (figures were interpreted as 95% confidence)

2. Concentration and Dilution Abilities

Thirty six subjects exhibited maximal concentrating abilty of 1195 ± 218 mOsm/L. It was quite interesting that urine osmolality always dropped after injection of pitressin. Minimal ditution to 49 ± 9.96 mOsm/L was observed.

3. Glomarular filtration rate and rensmal plasma flow

	No subjects	Mean ± S.D. ml/min/1.73 M²	Normal ml/min/1.73 M²
Inulin clearance	25	109 ± 20.8	male 131 ± 21.5
Creatinine clearance	25	105.5 ± 22.8	female 117 ± 15.6
PAH Clearance	24	446 ± 104	male 697 ± 136
Filtration fraction	24	0.24 ± 0.03	female 594 ± 102
			0.22 — 0.27

4. Sweat Composition

	No. sujects	mean ± S.D.	Normal (Anderson) adult
Sodium (mEg/L)	36	32.2 ± 12.16	27-87 (Av.65)
Potassium (mEg/L)	36	10.4 ± 4.8	10-15
Chloride (mEg/L)	34	25.1 ± 10.45	19-82 (Av.52)

5. Plasma Chemistry

	No. Subjects	Mean ± S.D.		Normal (Text)
Cholesterol mg%	37	168 ± 26.2		100-240
Total Protein Gm%	34	7.17 ± 0.31		6.3-8.0
Albumin Gm%	34	4.16 ± 0.59		4.23
Globulin Gm%	34	3.01 ± 0.72		3.34
Alpha-1 Gm%	34	0.22 ± 0.18		0.47
Alpha-2 Gm%	34	0.65 ± 0.20		0.75
Beta Gm%	34	0.74 ± 0.17		0.91
Gamma Gm%	34	1.36 ± 0.38		0.76
Osmolality mOsm/L	38	284 ± 4		270-310
Sodium mEg/L	38	139 ± 2		134-145
Potassium mEg/L	38	4.25 ± 0.51		3.5-5.3
Chloride mEg/L	38	104 ± 1		97-108
			male	3-6.3
Uric acid mg%	37	3.89 ± 0.79	female	1.7-5.5
Creatinine mg%	38	0.61 ± 0.35		0.4-1.4
Urea Nitrogen mg%	38	11.0 ± 1.82		10-20
Calcium mg%	27	9.42 ± 0.99		8.5-10.5
Phosphorus mg%	27	5.73 ± 0.89		4.0-5.5

Interpretation: 1. Thai children admitted for this study excreted relatively high urine volume and low osmolar concentration per litre. This was related to high water intake (average 2742 ml./day as water) because of hot weather. These children also excreted lower solute excretion when compared with average Americans. This can be explained by low protein diet in Thai. Low protein diet was also demonstrated by low urea and low phosphate excretion. Urinary excretion of other metabolites was within normal limits.

2. Thai subjects showed normal dilution ability and slightly lower concentration ability. Impairment of maximal urinary concentration ability has also been observed in healthy subjects who were permanent inhabitants of hot area of Israel.

3. Glomerular filtration rate and renal plasma flow were in lower limits of normal. Creatinine clearance when periodically performed by catheterization was closely similar to inulin clearances whereas 24 hrs creatinine clearance was slightly lower.

4. Sweat composition were in normal ranges.

5. Plasma protein was in normal ranges, Alpha-1 globulin was significantly lower and gamma globulin was definitely higher than standard. The high incidence of infection plays important role in high gamma globulin in this country. Others plasma chemistries were in normal limits.