Electrolytes in Healthy Subjects

Pages with reference to book, From 269 To 272

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Abstract

Serum and urinary electrolytes were determined in 200 apparently healthy males and females of different age groups retresenting various socio-economic status. The concentration of serum electrolytes in children and adults was the same(JPMA 33:269, 1983).

Introduction

The electrolytes are the frame work on which is built the composition of body water compartments. The major cations are sodium and potassium and the anions are chloride and bicarbonate. Sodium is largely associated with chloride and bicarbonate in the regulation of acid base equilibrium.
Kidneys play a dominant role in regulating both the electrolytes concentration and acid base balance of extracellular fluids.
Electrolyte determinations were undertaken in order to define the distribution characteristic in normal subjects.

Material and Methods

Two hundred blood and twentyfour hour urine samples from apparently healthy individuals of both sexes were collected. The age and sex distribution is shown in the accompanying figure.

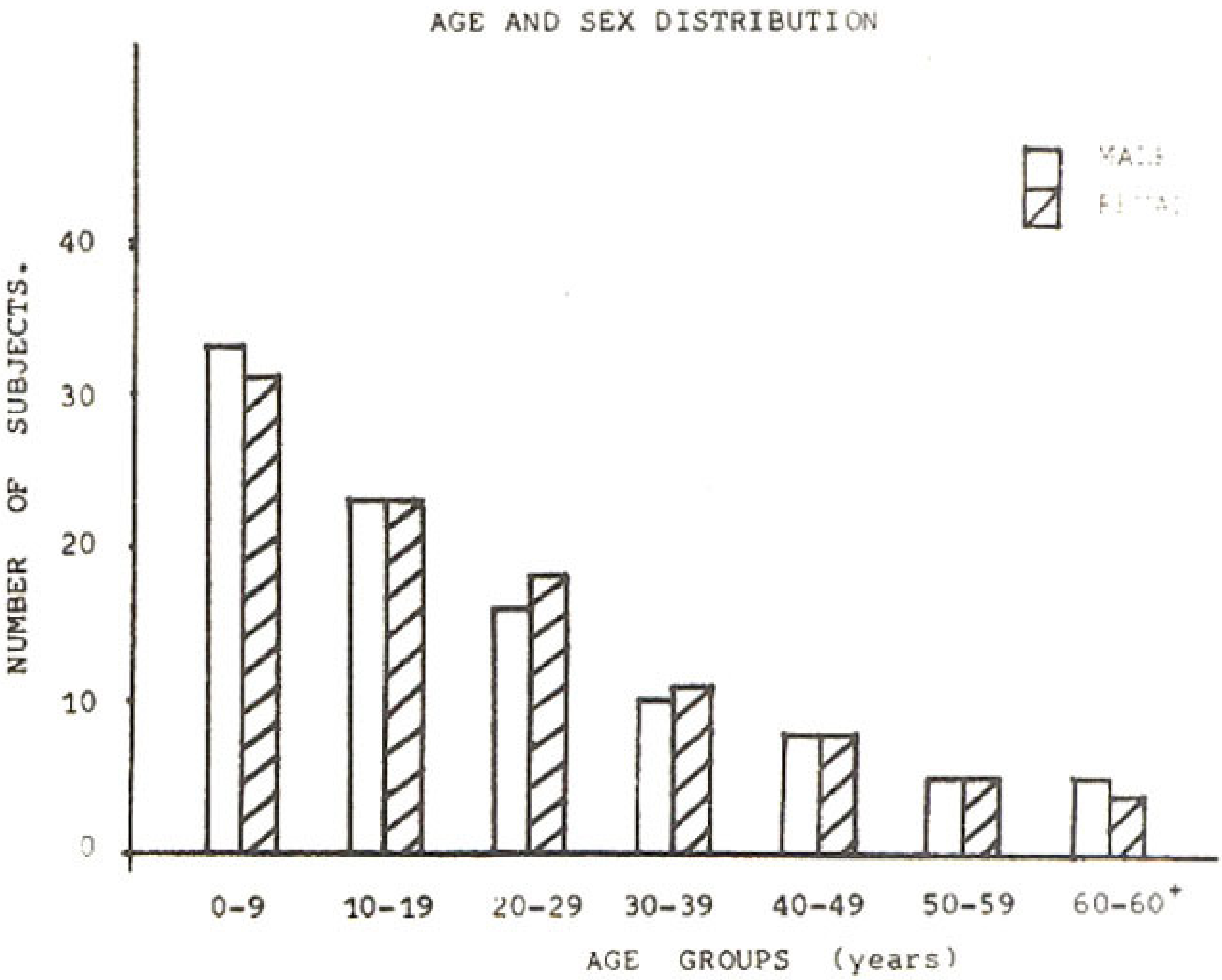

Fig. Age and Sex distribution.

Sodium and potassium were determined by flame photometry in blood and twentyfour hour urine samples. Serum chloride was estimated by the titration method of Schales and Schales (1941). Serum bicarbonate was analysed. by micro-carbon dioxide system, a simplified version of classical Van Slyke method (Harleco kit).

Results

Table – I

Serum and Urinary Electrolytes in Healthy Males.

AGE GROUPS (years)	SERUM (meq/L) Sodium	Potassium	Chloride	Bicarbonate	Urine(meq/24 hrs) Sodium	Potassium
	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)
0–9	145 ± 1.33 (132–160)	4. 18 ± 0.08 (3.4–5.4)	101 ± 0.7 (92–111)	25 ± 0.2 (23–27)	158.5 ± 10.6 (90–264)	31 ± 1.62 (25–80)
10–19	142 ± 1.4 (132–154)	4.1 ± 0.08 (3.4–4.8)	100.8 ± 0.88 (96–108)	25 ± 0.27 (23–28)	181.5 ± 11.3 (98–296)	33 ± 1.8 (26–70)
20–29	140.25 ± 1.22 (134–150)	3.9 ± 0.11 (3.4–4.8)	103.8 ± 1.25 (92–108)	25.5 ± 0.27 (24–28)	146.4 ± 12.9 (80–240)	32 ± 2.7 (25–72)
30–39	144.4 ± 2.8 (132–154)	4.3 ± 0.13 (3.4–4.6)	103.2 ± 1.11 (100–108)	24.7 ± 0.40 (23–27)	168 ± 14.3 (100–244)	37 ± 4.5 (27–79)
40–49	144.5 ± 1.93 (134–152)	4.1 ± 0.10 (3.8–4.6)	104.9 ± 1.1 (100–108)	25.3 ± 0.42 (24–28)	146±14.4 (88–208)	33 ± 5.4 (24–73)
50–59	141.6 ± 3.7 (134–156)	4.0 ± 0.15 3.6–4.6)	98.4 ± 0.67 (96–100)	26 ± 0.7 (23–27)	143 ± 19.8 (104–228)	39.4 ± 7.9 (26–72)
60–60+	140.8 ± 2.3 (134–148	4.0 ± 0.24 3.4–4.8)	101 ± 2.4 (92–108)	25 ± 0.6 (23–27)	161.6 ± 31.3 (80–264)	36.6 ± 7.9 (26–71)

Table – II

Serum and Urinary Electrolytes in Healthy Females.

AGE GROUPS (years)	SERUM (meq/L) Sodium	Potassium	Chloride	Bicarbonate	Urine (meq/24 hrs) Sodium	Potassium
	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)	Mean ± S.E. (Range)
0–9	143 ± 1.45 (132–156)	4. 0 ± 0.08 (3.4–4.8)	100.7 ± 0.85 (92–113)	25 ± 0.21 (23–28)	161 ± 11.0 (80–276)	34 ± 2.0 (27–82)
10–19	142 ± 1.75 (132–160)	4.0 ± 0.09 (3.4–4.8)	102. ± 0.10 (92–108)	24.7 ± 0.25 (23–27)	166.5 ± 11.0 (80–260)	32 ± 2.0 (25–75)
20–29	139 ± 1.2 (132–148)	3.8 ± 0.06 (3.4–4.2)	100 ± 0.98 (92–108)	24.5 ± 0.21 (23–26)	158 ± 11.7 (96–252)	34.8 ± 2.4 (28–74)
30–39	145.6 ± 2.8 (132–164)	4.35 ± 0.09 (3.8–4.8)	104 ± 1.3 (96–108)	24.6 ± 0.35 (23–27)	186 ± 14 (116–280)	34.3 ± 3.6 (27–71)
40–49	144 ± 2.2 (136–156)	3.9 ± 0.11 (3.4–4.4)	101.5 ± 1.4 (100–112)	24.4 ± 0.3 (23–25)	154 ± 19 (86–256)	33 ± 5.0 (24–70)
50–59	143 ± 2.3 (134–148)	4.2 ± 0.12 (3.8–4.6)	101.8 ± 2.4 (95–108)	24.8 ± 0.71 (23–27)	148 ± 15 (84–176)	39.5 ± 8.2 (28–75)
60–60+	141 ± 2.4 (136–146)	3.9 ± 0.14 (3.6–4.2)	98 ± 1.2 (95–100)	24 ± 0.47 (23–25)	115 ± 12 (88–140)	40 0 ± 12.2 (25–70)

Table I and II represents serum and urinary electrolytes concentration in apparently healthy males and females of various age groups.

In the present study the mean and ranges of serum electrolytes concentration for two hundred subjects of both sexes was as follows:

The mean and ranges for urinary electrolytes concentration was:

Sodium=161.5 meq/24 hrs (80-296 meq/24 his)
Potassium33.6 "(24-82 meqJ24 his)

Discussion

Sodium and potassium ions are particularly important for the regulation of acid base balance as hydrogen ions are substituted for sodium and potassium ions in the renal tubule.

Although salt and water intake varies considerably, the serum sodium concentration in normal individuals remains fairly constant between 135-145 meq/l. The major part of the osmotically active solutes in the serum are the salts of sodium and the body preserves the total solute concentration in the serum within narrow limits of some 275-290 micromoles/kg water (Ring-Larsen, 1975). A slight rise of 1-2% in effective total solute concentration is able to stimulate maximal release of antidiuretic hormone (Verney, 1947). In the present study the serum sodium concentration of children is similar to that of adults as the total solute concentration of body liquids is not affected by growth.

Serum sodium determinations are useful in detecting gross changes in water and salt balance. Potassium status is important because it influences general wellbeing through its physiological effects on muscle contraction and cardiac function, on hydrogen ion exchange in the tubules and acid base balance (Aikawa et al., 1953; Burrows et at., 1953).

The liver is the store house for potassium because of its high concentration of metabolically active cells and its great metabolic activity requiring potassium ion transport (Noonan et at., 1941). Potassium is more important than sodium because potassium bicarbonate is the primary intracellular inorganic buffer (Gambino, 1969). Like serum sodium, potassium also showed no difference in children and adults in the healthy subjects. The value was within the range of 3.4-5.4 meq/I. As stated, potassium balance can be maintained on an average dietary intake of 80-200 meq/day (Gambino, 1969).

Chloride ions play an essential role in the cor rection of hypokalaemic alkalosis. If potassium is supplied without chloride, hypokalaemic alkalosis may persist (Gambino, 1969). Serum chloride in the present study showed no variation in the concentration of various age groups studied. The level was between 92-113 meq/l. Similar values were reported by Todd (1969).

Bicarbonate ion constitutes a metabolic step in moving carbon dioxide from tissues, to lungs (Bland, 1963). The ion amounts to 10-12 meq/kg of body weight. About 50% is present in the extra cellular fluid and the remainder in intracellular. Most of the bicarbonate is exchangeable (West et al., 1966). Acid substances produced as an end product of metabolism are buffered mainly by the bicarbonate carbonic acid buffer system and from the glomeruli they pass into the filtrate as salts (Raphael, 1976). Recent findings showed the values between 23-28 meq/l and showed no difference in children and adults. The concentration of bicarbonate is regulated by renal function (Gambino, 1969).

Urinary sodium excretion is a sensitive indicator of altered sodium balance. In general sodium excretion tends to reflect sodium intake. With adrenal insufficiency there is inappropriate sodium excretion and alternatively when aldosterone production is increased, sodium excretion is decreased (Gambino, 1969). In the apparently healthy population studied, sodium excretion was between 80-296 meq/24 hours. Wide variation in the mean value of various age groups was not found. The observed range is in accordance with the previous findings (Raphael, 1976).

The urinary excretion of potassium varies with diet but usually ranges between 40-80 meq/ day (Gambino, 1969) whereas the range observed in our study is from 24-82 meq/24 his.

Thus the electrolytes of the body fluids have various functions, the chief of which is to contribute most of the osmotically active particles, to provide buffer system and mechanism for the regulation of acid base balance and to give the proper ionic balance for normal neuromuscular irritability and tissue formation.

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