Supporting Text

Methodology. In Table 2, the prerace total body water (TBW_1, column C) was calculated as 0.6 times prerace weight (i.e., column B); change TBW (ΔTBW) during the race (column D) was calculated as the difference between fluid loss and fluid intake until normalization of serum [Na^+] or until the subject was discharged from hospital on the grounds of clinical recovery; Na^+ balance during the race (column E) was calculated as the difference between Na^+ intake and Na^+ loss during recovery; measured post race serum [Na^+] (column F) was the value reported in the published studies; predicted postrace serum [Na^+] (column G) was calculated according to the equation of Nguyen and Kurtz (1)

$$[Na^+]_{2p} = \frac{\left([Na^+]_{1p} + 23.8\right)TBW_1 + 1.03\Delta E}{TBW_1 + \Delta TBW} - 23.8$$

in which $[Na^+]_{1p}$ = the prerace serum Na^+ at the start of the balance study; TBW_1 is as calculated as for column C; ΔE is net Na^+ gain or loss from intake and output records during recovery; and ΔTBW is net fluid loss from intake and output records during recovery; the difference between the measured (column F) and the predicted (column G) postrace serum [Na^+] is given in column H; the amount of osmotically-active Na^+ that was inactivated (negative values) or conversely the amount of osmotically-inactive sodium activated to Na^+ (positive values) to explain the discrepancies in column H is listed in column I. This calculation is made using the equation of Nguyen and Kurtz (1) for a $\Delta TBW = 0$. For $\Delta TBW = 0$, the Nguyen–Kurtz equation simplifies to

$$\Delta E = \frac{TBW_1}{1.03} \times \Delta[Na^+]_p \qquad [2]$$

Column J provides the reference for the origin of these data.

Table 3 provides the calculations for the same 18 subjects to calculate the amount of sodium that was either osmotically-activated or inactivated during the recovery period of the study after the race and the total Na^+ balance for the entire duration of the study. The athletes are split on the basis of those athletes who showed an activation of osmotically-inactive, exchangeable sodium during the recovery period (top group) and those who inactivated osmotically-active Na^+ during recovery (bottom group). Columns B and C repeat the body weights and measured postrace serum $[Na^+]$ reported in Table 2 and which for this calculation is $[Na^+]_{1p}$. Column D lists the measured serum $[Na^+]$ at the end of the study period; Column E is the predicted postrecovery serum $[Na^+]$ based on the Nguyen-Kurtz equation (1) in which $[Na^+]_{1p}$ = postrace serum $[Na^+]$ at the start of the balance study; $TBW_1 = 0.6 \times$ PreRace Wt + net water loss during hospitalization; ΔTBW = net water loss during the study; and ΔE = net sodium gain during the balance study. Column F lists the predicted minus the observed postrecovery serum $[Na^+]$; and Column G records the calculated amount of sodium that was osmotically-activated (positive values) or osmotically inactivated (negative values) during recovery to explain these discrepancies. As in Table 2 (column I), this calculation is made for a $\Delta TBW = 0$, using the simplified Nguyen-Kurtz equation already described; Column H lists the amount of Na^+ infused or ingested during recovery; whereas Column I records the calculated total Na^+ balance for the entire prerace to postrecovery period.

Appendix: Estimate of the Size of the Osmotically Inactive Exchangeable Sodium Stores. In Edelman *et al.*'s empirical equation (3), plasma water sodium concentration ($[Na^+]$) was found to be primarily a linear function of the exchangeable Na (Na_e) plus the exchangeable potassium (K_e) divided by the TBW so that $[Na^+] \alpha (Na_e + K_e)/TBW$. The equation also had a non-zero intercept which Edelman *et al.* thought to be a *variable* measure of exchangeable, but osmotically inactive sodium plus potassium. Nguyen and Kurtz (1) showed the y-intercept to be the sum of 4 terms, one of which includes the sum of osmotically inactive Na_e and K_e. Thus, in Edelman *et al.*'s hypothesis the term for osmotically inactive sodium plus potassium would equal the y-intercept value, with the other three terms summing to zero.

Exchangeable sodium (Na_e) consists of both osmotically active ($Na_{e,act}$) and osmotically inactive ($Na_{e,inact}$) sodium (1). Exchangeable sodium is ≈70% of total body sodium. Since total body sodium is ≈60 meq/kg body weight, exchangeable sodium is about 42 meq/kg (4).

Because $Na_e = Na_{e,act} + Na_{e,inact}$,

$Na_{e,inact} = Na_e - Na_{e,act}$

All $Na_{e,act}$ is in body water. In intracellular fluid, its concentration is 14 meq/liter, and in extracellular fluid, 140 meq/liter (5).

Consider a 70-kg person. Total exchangeable sodium is 70 kg × 42 meq/kg = 2,940 meq. Assume that TBW (in liters) is 42 liters, distributed as two-thirds or 28 liters of ICF, and 1/3 or 14 liters of ECF.

Osmotically active sodium can be estimated thus:

ICF: 28 liters × 14 meq/liter = 392 meq

ECF: 14 liters × 140 meq/liter = 1960 meq

TOTAL $Na_{e,act}$: 392 + 1960 = 2352 meq.

Thus, $Na_{e,inact}$ is:

2940 – 2352 = ≈600 meq.

With respect to body weight: 600 meq/70 kg = 8.6 meq/kg.

With respect to body water: 600 meq/42 liters = 14 meq/liter body water.

This number should be viewed as an estimated average only. It likely varies interindividually (3) and it has been demonstrated to vary significantly intraindividually over time (6–8).

1. Nguyen, M. K. & Kurtz, I. (2004) *Am. J. Physiol.* **287,** F172–F180.

2. Weschler, L. B. (2005) *Sports Med.* **35,** 899–922.

3. Edelman, I. S., Leibman, J., O'Meara, M. P. & Birkenfeld, L. W. (1958) *J. Clin. Invest.* **37,** 1236–1256.

4. Edelman, I. S. & Leibman, J. (1959) *Am. J. Med.* **27,** 256–277.

5. Guyton, A. C. & Hall, J. E. (2000) *Textbook of Medical Physiology* (Saunders, Philadelphia).

6. Heer, M., Baisch, F., Kropp, J., Gerzer, R. & Drummer, C. (2000) *Am. J. Physiol.* **278,** F585–F595.

7. Titze, J., Maillet, A., Lang, R., Gunga, H. C., Johannes, B., Gauquelin-Koch, G., Kihm, E., Larina, I., Gharib, C. & Kirsch, K. A. (2002) *Am. J. Kidney Dis.* **40,** 508–516.

8. Titze, J., Krause, H., Hecht, H., Dietsch, P., Rittweger, J., Lang, R., Kirsch, K. A. & Hilgers, K. F. (2002) *Am. J. Physiol.* **283,** F134–F141.