Drinking to Thirst

Written by Meg Garvey, PhD.

NIX™

Abstract

Replenishing fluids is critical to maintaining proper hydration and thereby optimizing safety and performance. Replenishing fluids ad libitum (or drinking to thirst) remains the most popular method of assessing fluid needs. However, this method of hydration management is frequently misleading and thereby poses significant risks. Seminal research has demonstrated that athletes drinking ad libitum (drinking to thirst) consume only half of the fluids lost during exercise in both hot and cool environments (1). The American College of Sports Medicine advises athletes to avoid relying on thirst alone to gauge their fluid replacement needs (2). Nix proprietary research demonstrates that drinking ad libitum results in not only under-hydrating but over-hydrating as well - a risk that is heightened for workouts over 60 minutes. This paper investigates the efficiency of ad libitum fluid consumption within our proprietary validation data set.

Rehydration Data Analysis

Data were obtained from 1,122 hydration tests with runners and cyclists who were instructed to drink to thirst (data collected between October 2021 and March 2023). This data set included 1,122 workout observations among 211 athletes (81% female, 78.4% non-Hispanic white, with ages ranging from 18-72 years) demographics of this population are summarized in Table 1.

NIX™

Population Demographics

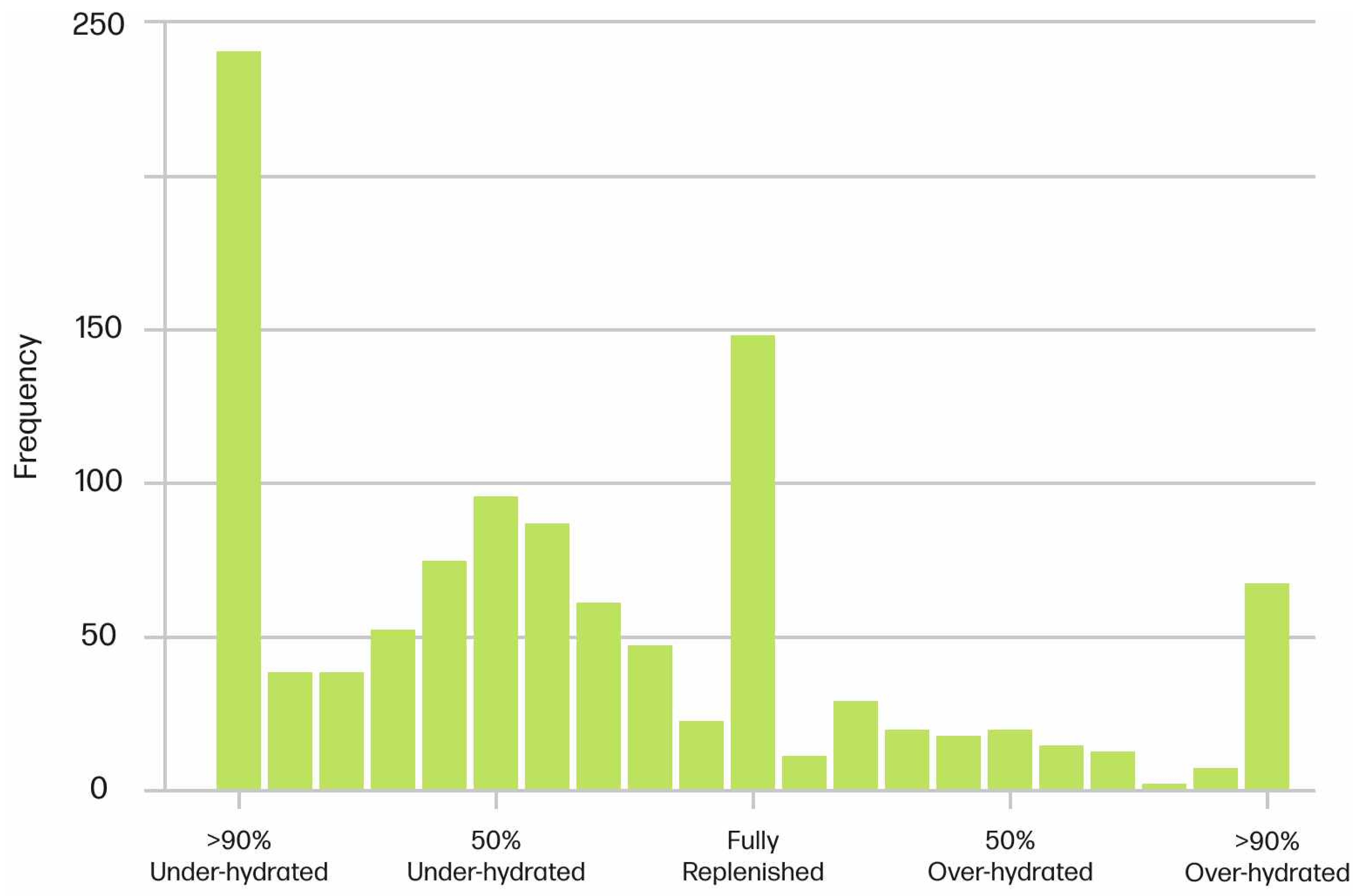
Variable		All observations n = 1,122
Individual Athletes		207
Age		30.1 (±10.0)
Sex		
	Female	909 (81.0%)
	Male	212 (18.9%)
	Non-Binary	1 (0.1%)
Race/Ethnicity		
	White non-Hispanic	877 (78.4%)
	White Hispanic	24 (2.2%)
	Black non-Hispanic	54 (4.8%)
	Black Hispanic	3 (0.3%)
	Asian	110 (9.8%)
	Pacific Islander	47 (4.2%)
	Multi-racial	3 (0.3%)
BMI		24.8 (± 46.5)
	Under-weight	30 2.7%)
	Normal	781 (69.6%)
	Over-weight	265 (23.6%)
	Obese	46 (4.1%)
Time		61.4 (± 45.3)
	<60 minutes	867 (77.3%)
	60-90 minutes	78 (7.0%)
	90-120 minutes	73 (6.5%)
	120-150 minutes	28 (2.5%)
	>150 minutes	76 (6.8%)
Sport		
	Running	720 (64.2%)
	Cycling	402 (35.8%)
Fluid Consumed (oz)		18.1 (± 22.6)
Sweat Loss (oz)		29.4 (± 27.2)
Sweat Rate (oz/hr)		27.7 (± 13.8)
RPE		5.5 (± 2.3)
Temperature (F)		63.6 (± 27.2)
Humidity (%)		54.9 (± 17.8)

RPE, rate of perceived exertion

The data shows that drinking to thirst prompted reasonably accurate fluid replenishment - i.e., +/-10% of their actual fluid loss - only 16% of the time (Graph 1). This means drinking to thirst was ineffective for 84% of athletes in the data set (n = 1,122). In fact, over 56% of athletes under-hydrated by 40% or more. Equally problematic, 18% of athletes over-hydrated by 20% or more, with 6% over-hydrating by more than 90% - a potentially dangerous risk of hyponatremia.

Graph 1

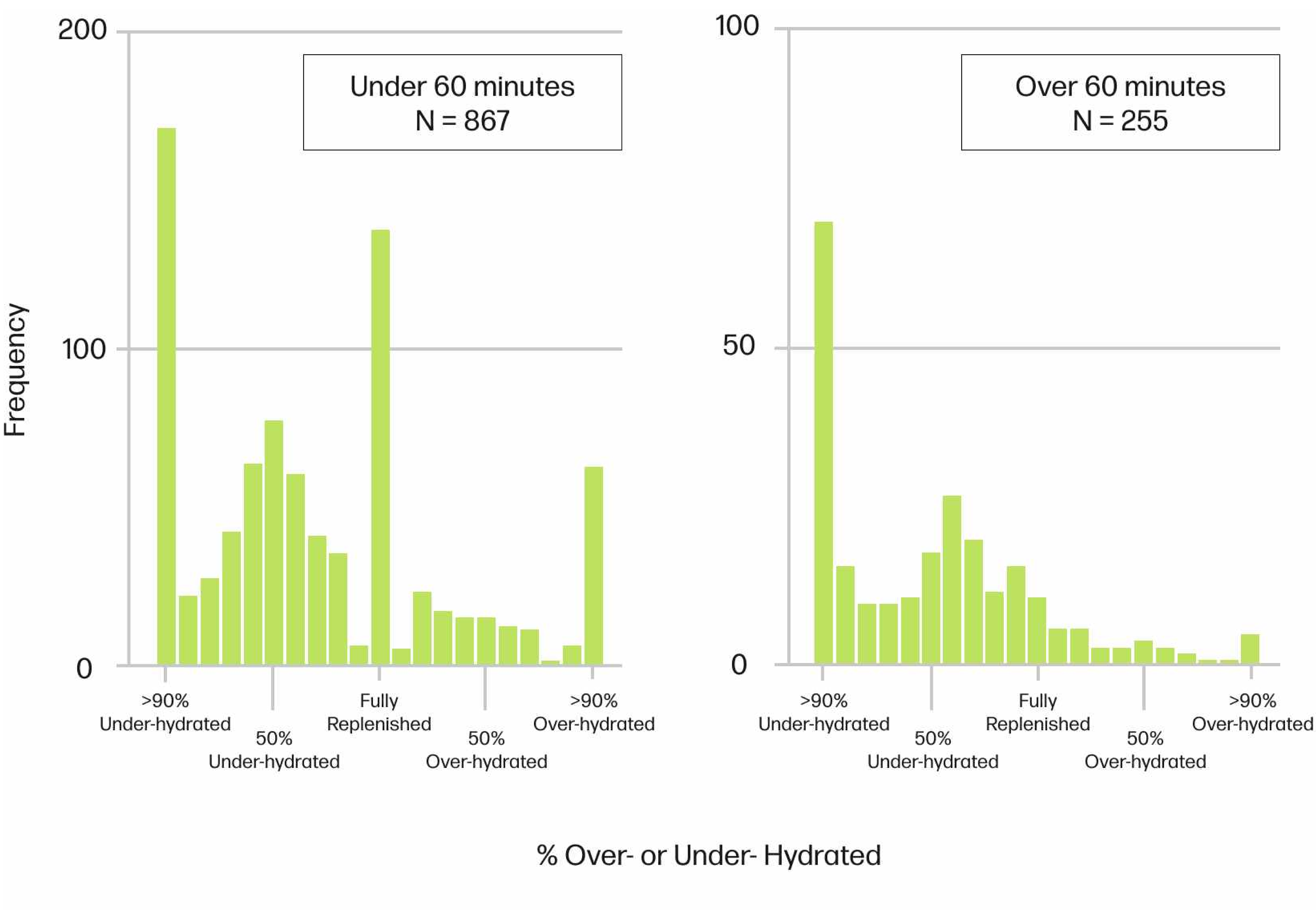
Drinking to Thirst Percentage Replenishment (n = 1,122)



The data was further broken down by the length of the workout (Graph 2). Athletes conducting workouts lasting longer than 60 minutes (n = 255) were at greater risk for improper rehydration while drinking to thirst. For workouts lasting longer than 60 minutes, reasonably accurate fluid replenishment - i.e., ±10% of their actual fluid loss - occurred only 4.3% of the time, as compared to 15.9% in the full data set. A total of 76.1% of athletes replenished less than 20% of their fluids lost. More than a quarter of athletes - 27.5% - replenished less than 90% of fluids lost. Two percent of athletes in this group over-hydrated by 90% or more.

Graph 2

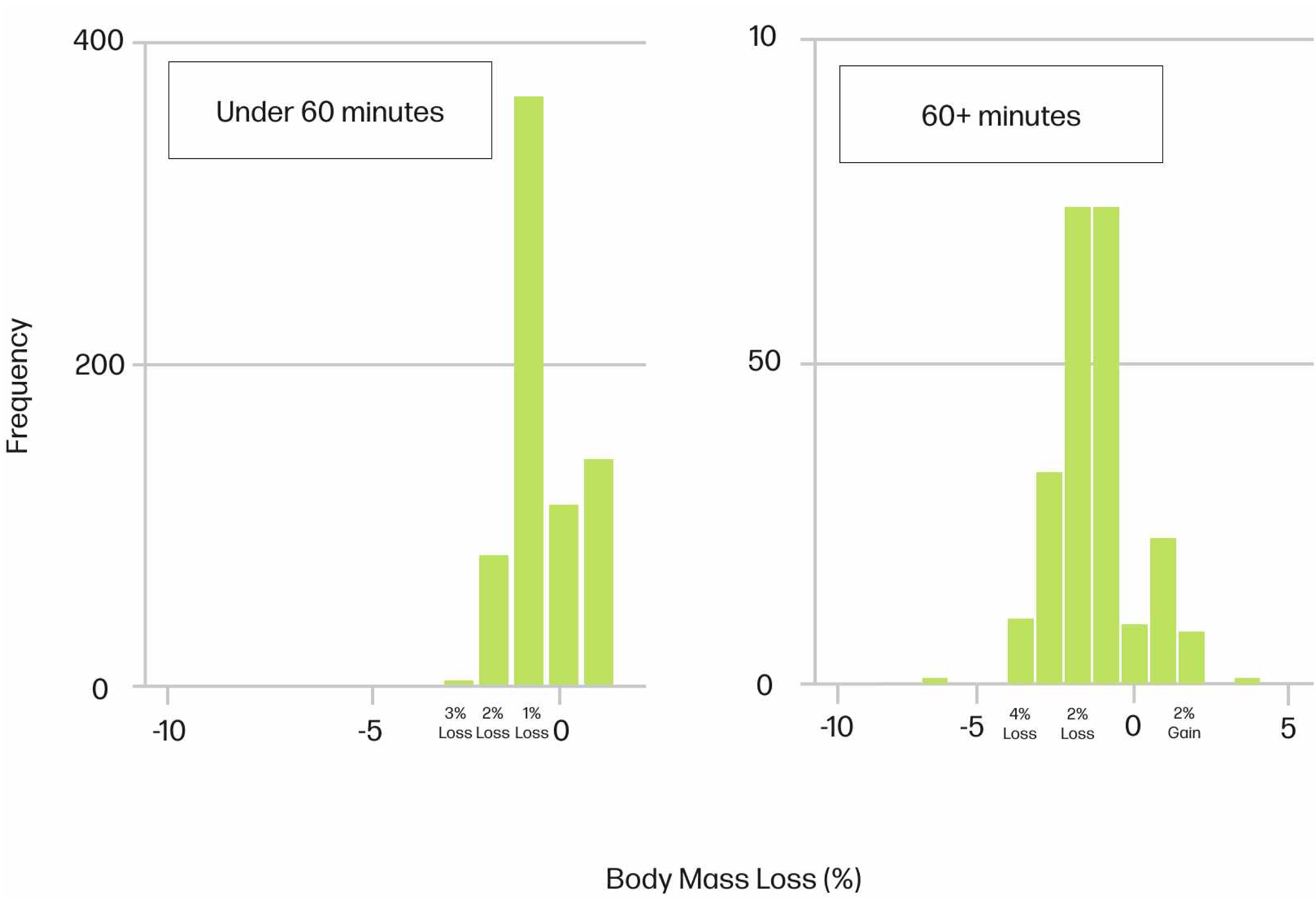
Drinking to Thirst Percent Replenishment by Exercise Duration



The data was further broken down by the length of the workout (Graph 2). Athletes conducting workouts lasting longer than 60 minutes (n = 255) were at greater risk for improper rehydration while drinking to thirst. For workouts lasting longer than 60 minutes, reasonably accurate fluid replenishment - i.e., ±10% of their actual fluid loss - occurred only 4.3% of the time, as compared to 15.9% in the full data set. A total of 76.1% of athletes replenished less than 20% of their fluids lost. More than a quarter of athletes - 27.5% - replenished less than 90% of fluids lost. Two percent of athletes in this group over-hydrated by 90% or more.

Graph 3

Drinking to Thirst Level of Dehydration in Percent of Body Mass Lost



It is also worth noting that 19% of the total workouts observed, and 13.6% of workouts over one hour, resulted in over-hydrating when compared to the fluids being lost. This type of behavior puts an athlete at risk of exercise-associated hyponatremia, a condition associated with critically low plasma sodium levels which could lead to swelling in the brain and the lungs resulting in death (5). It has been noted that fluid accessibility during certain competitions may also exacerbate this impulse to overconsume. While the International Association of Athletics Federations recommends feed zones/water stations to be placed approximately 3 miles away from each other, many races include more frequent stops (6). Athletes participating in such races, especially those who fall into a more "recreational racer" group, should educate themselves before race day on their typical hydration requirements and the importance of fluid balance to prevent over-hydrating, which comes with its own set of side effects.
One limitation of this analysis was the timing of data collection periods. This analysis is based on a data set obtained at a mean temperature 63.6 ±27.2 °F for both indoor and outdoor workouts. As sweat rates tend to be positively correlated with increasing temperatures there may be some temperature influences that are missing from this analysis. As such, this study should be repeated in a wider range of environmental conditions.

Conclusion

While drinking to thirst is a convenient method of managing hydration, this strategy has been found to lead to significant mis-estimation of fluid losses during exercise, leading to widespread dehydration or over-hydration. The risk is further exacerbated for activities lasting longer than 60 minutes. Athletes could benefit from having a personalized, data-driven hydration plan in place to optimize hydration and reduce subsequent performance impairments, and other health-related side effects. This assertion is confirmed by the American College of Sports Medicine (8). Tracking actual hydration requirements during training sessions not only improves the training effectiveness of each of those sessions but also allows for more data to be considered when creating competition hydration planning for optimal performance.

NIX™

References

1. Knechtle, B., Di Gangi, S., Rüst, C. A., & Nikolaidis, P. T. (2020). Performance differences between the sexes in the Boston marathon from 1972 to 2017. The Journal of Strength & Conditioning Research, 34(2), 566-576.
2. O'Neal, E. K., Wingo, J. E., Richardson, M. T., Leeper, J. D., Neggers, Y. H., & Bishop, P. A. (2011). Half-marathon and full-marathon runners' hydration practices and perceptions. Journal of Athletic Training, 46(6), 581-591.
3. Del Coso, J., Salinero, J. J., Abián-Vicen, J., González-Millán, C., Garde, S., Vega, P., & Pérez-González, B. (2013). Influence of body mass loss and myoglobinuria on the development of muscle fatigue after a marathon in a warm environment. Applied physiology, nutrition, and metabolism, 38(3), 286-291.
4. Baron, S., Courbebaisse, M., Lepicard, E. M., & Friedlander, G. (2015). Assessment of hydration status in a large population. British Journal of Nutrition, 113(1), 147-158.
5. Thomas DT, Erdman KA, Burke LM. American College of Sports Medicine Joint Position Statement. Nutrition and Athletic Performance. Med Sci Sports Exerc. 2016;48(3):543-68.
6. ACSM's Health & Fitness Journal 8(3):p 2, May 2004.
7. Greenleaf, J. E., & Sargent, F. (1965). Voluntary dehydration in man. Journal of Applied Physiology, 20(4), 719-724.
8. Cheuvront SN, Montain SJ, Sawka MN. Fluid replacement and performance during the marathon. Sports Med. 2007;37:353–7.
9. Osterberg, K, Horswill, C, Baker, L (2009). Pregame Urine Specific Gravity and Fluid Intake by National Basketball Association Players During Competition. Journal of Athletic Training, 44(1), 53-57.
10. Baker, L. (2017). Sweating Rate and Sweat Sodium Concentration in Athletes: A Review of Methodology and Intra-Interindividual Variability. Sports Medicine, 47, 111-12.