

Letter to Editor

Fluid ingestion strategies of competitive cyclists during 40 km time trial competition

Dear Editor-in-Chief,

Loss of fluid during prolonged exercise has been purported to be a cause of fatigue (Below et al., 1995; Walsh et al., 1994, for example). A plethora of information regarding 'optimal' fluid replacement strategies exists; perhaps the most prominent of these in the public domain is the position stand on exercise and fluid replacement published by the American College of Sports Medicine (ACSM). It recommends that one should ingest fluid early and continually at regular intervals in an attempt to replace the volume of fluid lost through sweating or consume as much as can be tolerated (Covertino et al., 1996). Drinking practices associated with different types of endurance activity are not well documented and it may be possible that the guidelines based on empirical data derived from laboratory conditions lack the necessary ecological validity for performance in the field. To our knowledge, there are no data on fluid intake or body mass losses during high-intensity cycling time trials (TT) outside of laboratory conditions; although a pilot study questionnaire used by El-Sayed et al. (1997) revealed that the volume ingested in pre-race preparation over a similar TT race distance (46 km) ranged between 0.125-0.5 L. Therefore the aim of this investigation was to elucidate the fluid ingestion strategies of competitive cyclists during pre-race preparation and 40 km TT competition and the resultant body mass loss.

Seventy-two competitive male cyclists ranging from Elite Category to Category 4 cyclists (according to British Cycling classification) volunteered to participate in this investigation from two separate 40 km TT ($n = 21$ and $n = 51$, respectively). Mean (\pm SD) body mass, height and age for all participants were 73.4 ± 7.5 kg, 1.77 ± 0.06 m, and 47 ± 13 years. All procedures were approved by the University's Research Ethics Committee and subjects completed informed consent prior to the start of the investigation.

Both events were held on 'out and back' courses. Environmental conditions were dry, 19°C and 48% relative humidity during TT1. During TT2 riding conditions were wet in places, the temperature was 16°C and the

relative humidity was 64%. After voiding, cyclists' body mass was measured along with the bottle that each participant was to use during the TT. The fluid volume consumed was recorded post-warm-up and 5 min post-TT; body mass was also recorded 5 min post-TT. Fluid replacement was calculated as the volume of fluid ingested during the warm-up and TT expressed as a percentage of the total loss in body mass. Spearman Rho correlation analysis was used to determine the relationship between fluid replacement and average TT speed. Independent samples t-tests were used to determine differences between mean TT speed, ingested fluid volume and body mass loss.

The mean speed for both TT were 39.27 ± 2.59 $\text{km}\cdot\text{h}^{-1}$ (range: $46.02 - 33.18$ $\text{km}\cdot\text{h}^{-1}$). The mean speed for the individual TT1 and TT2 was 40.46 ± 2.89 and 38.78 ± 2.31 $\text{km}\cdot\text{h}^{-1}$, respectively. Despite the moderate conditions and exercise duration of ~ 60 min, the mean body mass loss was 1.5 ± 0.5 kg ($1.8 \pm 0.6\%$ body mass). Body mass losses for TT1 and TT2 were 1.8 ± 0.5 kg ($2.1 \pm 0.7\%$ body mass) and 1.4 ± 0.4 kg ($1.7 \pm 0.5\%$ body mass), respectively. Approximately 60% ($n=43$) of riders consumed a pre-TT bolus of 0.343 ± 0.236 L. The remaining 29 athletes did not drink at any time during the pre-TT preparation or during the TT and no athletes chose to drink during the race. There was a significant, but nonetheless poor relationship between mean TT speed and fluid intake ($r = 0.28$, $p = 0.018$), but no significance between TT speed and percentage body mass loss ($r = 0.17$, $p = 0.16$). There was a significant difference between mean TT speeds ($p = 0.011$) and percentage body mass loss ($p = 0.004$), but not fluid intake ($p = 0.37$). Table 1 provides a summary of the volume and composition of the fluid ingested during the warm-up as well as the fluid replacement values. It is notable that the range for fluid replacement was between 2.8% and 61.5% of total body mass loss; mean ($20.4 \pm 12.0\%$).

This study has identified fluid replacement strategies and body mass losses sustained by competitive 40 km TT cyclists from field data. Recently, there has been an increased awareness of excessive hydration during endurance exercise (Noakes and Speedy, 2006). From our

Table 1. Composition, volume of fluid ingestion and percent fluid replacement of competitive TT cyclists. Values are means (\pm SD).

	Pre-time trial ingestion			
	Water (n = 6)	6% CHO (n = 25)	8% CHO (n = 7)	10% CHO (n = 5)
Volume (L)	.392 (.388)	.361 (.234)	.359 (.123)	.180 (.760)
Fluid replacement (% body mass loss)	21.1 (20.8)	22.6 (13.6)	23.5 (10.4)	14.1 (6.4)

CHO = carbohydrate

observations, the fluid volume ingested was similar to the recommended pre-competition volume of $0.005 \text{ L}\cdot\text{kg}^{-1}$ body mass (Burke et al., 1996), however, many cyclists do not meet the guidelines presented by the ACSM during exercise (Convertino et al., 1996). Many riders chose to ingest fluid during the warm-up period; however very few drank during the TT. It is important to point out that these data are limited to cycling TT in moderate conditions. Further research is warranted to determine the effects of different environmental conditions on actual TT performance outside the laboratory, to enable appropriate fluid replacement strategies to be devised.

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