Comment on 'Effects of fluid loss on the physiology of closed-circuit rebreather divers after 100- and 45-metre dives by Tuominen, et al.'

We have some difficulty in understanding the publication by Tuominen and colleagues because the description of methods and the presentation of results are less detailed than is required.[1] Those details could be provided in an on-line supplement.

Dehydration is when there is so much net loss of body fluid that it impairs normal bodily functions. There is no doubt that immersion promotes natriuresis and diuresis, but during most dives net fluid loss is not enough to impair normal bodily function: so there is not dehydration. We do not know of any convincing evidence that the amount of diuresis experienced by divers increases the risk of decompression sickness. There is more convincing evidence that high oral fluid intake before diving can increase the risk of immersion pulmonary oedema, which can prove fatal.

If one wishes to study the effect of diuresis when diving on any aspect of physiology the research should be conducted with adherence to strict scientific methods and protocols. For example it might involve a group of subjects having repeat interventions with every aspect held constant as far as that is possible other than the intervention that one is studying.

In the study by Tuominen and colleagues, a group of divers performed two dives (to 45 and 100 mfw) on separate occasions, but there was no consistency of dive durations between subjects. We are not told the range of durations for each depth, but the interquartile durations of the 45 mfw dives were 63–71 mins and of the 100 mfw dives were 155–178 mins, which represent greater than 10% variation for each depth. Partial pressures of gases breathed and uptake and elimination of inert gases during the dives were obviously very different between the two depths of dives and also between the different subjects doing the dives to the same depths because their dive durations were not identical.

It does not seem that there was a consistent interval between divers being weighed pre-dive and entering the water, during which interval the divers were putting on their diving suit and equipment, and we are not told how long this interval was for each diver. Neither was there a consistent interval between surfacing, de-kitting and getting weighed and we are not told what those intervals were. During the pre-dive and post-dive intervals there would have been urine production which will add to the weight change during the times the divers were underwater.

The weights of divers were measured using an InBody 720 composition analyser. It is used for measuring body composition using bioelectrical impedance rather than specifically designed for accurate total body weight. We cannot find reports on reproducibility of the equipment for weight measurement. It only measures to the nearest 0.1 kg which does not have enough precision for the small changes in weight reported.

Weights of individual divers or mean / median weights of the groups before and after each dive are not stated. We are told only the median weight loss and IQR for each dive.

There is a major concern that pre-dive hydration was different between the two dive depths and between divers doing the same dive. The divers had restriction of fluid intake for two hours before the 45mfw dives. For the 100 mfw dive "*the divers were allowed to hydrate as they normally do*" but we are not told how much water or other fluid each diver drank. Furthermore, during the dive the divers were allowed to urinate freely but the urine was not collected and the quantity produced by each diver was not measured.

If a diver consumed a large amount of fluid before the 100 mfw dives, his (or her) pre-dive weight would include the

weight of fluid in his gastrointestinal tract which is strictly extracorporeal. It is possible that absorption of water from the gastrointestinal tract during the dive would exceed the urine loss, so that weight would decrease but so would haematocrit as a result of haemodilution. This possibility is supported by the finding that after the 100mfw dive haematocrit decreased by 0.8%.

The authors of the study have assumed that the change in weight of a diver at the surface who is fully kitted up but did not perform the dives would be zero, i.e., there would be no insensible losses or production of urine over these periods of respectively more than 68 min for the 45 mfw dive and more than 170 min for the 100 mfw dive. (We say 'more than' because we do not know the amount of time out of the water before and after the dives between the two measurements of weight.) Not only is this assumption unrealistic but it skews the reported statistics in favour of a very small *P*-value. Furthermore, we have repeated the calculation of the regression coefficient for VGE grade versus weight change (Figure 2 in the paper) for the 45 mfw dive and we find that, in contradiction to the authors, the regression coefficient is *not* significantly different from zero, implying that there is *no* correlation between weight loss and VGE score.

We ask that the authors address these issues.

Reference

1 Tuominen L, Lundell R, Balestra C, Wuorimaa T, Koponen L, Sokolowski S, et al. Effects of fluid loss on the physiology of closed-circuit rebreather divers after 100- and 45-metre dives. Diving Hyperb Med 2025;55:391–7. doi: 10.28920/dhm55.4.391-397. PMID: 41364863.

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