Letter to the Editor

Anxiety impact on scuba performance

We are concerned about the scientific validity of a recent paper on the impact of anxiety on scuba performance[1] on the following basis:

1. In their analyses men and women were grouped together, whereas the two sexes should have been analysed separately. The chi-square comparing male:female/high:low anxiety produced the same *P*-value (0.15) as that reported, but the small female/low anxiety group (only three subjects) makes the result unreliable statistically. Therefore, one cannot be sure that there are no sex effects. If this initial assumption that there is no significant difference between the sexes cannot be relied upon, then this has a knock-on effect to all further analyses and to any inferences drawn.

2. It is unclear why the authors used the State-Trait Anxiety Inventory to measure only individual trait anxiety. Measuring individual 'State anxiety' immediately prior to the experimental trials would have been a more relevant test. The assumption that Trait anxiety measures provide an *a priori* threshold for the prediction of panic behaviour is based on the findings of a single study of novice scuba students undertaking a training course.[1] In the present study, the participants were certified open-water or advanced open-water divers, including one qualified rescue diver. Therefore, this is not an appropriate or true comparison. Also, whilst susceptibility to panic is associated with increased Trait anxiety, women are twice as susceptible to panic as men.[2] It is proposed that this sex-specific vulnerability arises due to an interaction with changes occurring during the premenstrual phase of the menstrual cycle.[3]

3. Submerging to 5 metres of fresh water in an outdoor pool is unlikely to be anxiety provoking with this cohort. Even those recording a high level of 'Trait anxiety' may be showing a low level of 'State anxiety' at the time of the dive; indeed, some may even have found it relaxing. Consequently, the statement that "*…this study sought to confirm the following issues: (1) whether anxious divers would exhibit slower diving skills performance; (2) whether anxious divers would have inefficient cognitive processing ability in underwater conditions;…*" is not supported without measuring State anxiety immediately prior to the experimental phases.

4. A previous study found no impairment in inhibitory control using Stroop at a depth of 5 m although it was observed at a depth of 20 m.[4] The finding of impairment in inhibitory control may, therefore, be due to sex differences rather than Trait anxiety. Furthermore, the effects of anxiety on performance may be modulated by sex.[5,6] Unfortunately there is no published research on sex differences in diver performance. In some other situations, highly anxious women outperform men; in other cases, men outperform women and at times there is no difference in performance. Also population distribution may be skewed with one group showing a normal distribution whilst the other may have either an unimodal or bimodal distribution. Recent work (by JL, unpublished) on differences in behaviour between men and women in survival situations suggests that men tend to show a more or less normal distribution and women a more bimodal distribution in coping ability. There can also be within-population differences amongst women given that the menstrual cycle can mediate State anxiety in its effect on cognitive function.[3] Differences in fear and anxiety between men and women are complex issues influenced by a broad range of factors.[2]

5. The Stroop test cannot be used reliably as a sole measure of executive function, let alone cognitive function. Whilst it does measure interference control, which is a sub-component of executive function, there are other sub-components to be considered. One author (JL) has found in his own work that duress affects these sub-components differentially; in other words, not all subcomponents of executive function are impaired under the same conditions.

In summary, the authors should consider retracting their paper on the grounds that, most importantly, the sex/anxiety premise is unsound, given the unreliable initial chi-square analysis, and the knock-on implications of this to the rest of the analyses. Secondly, what is concluded does not provide any new contribution to the field. To study possible sex differences in task performance (mask clearing, buddy breathing, etc.) either to eliminate them or to identify possible differential effects would require an appropriate-sized (larger) study sample. Either that or the study cohort should have been of only one sex.

References

1 Tsai F-H, Wu W-L, Liang J-M, Hsu H-T, Chen T-Y. Anxiety impact on scuba performance and underwater cognitive processing ability. Diving Hyperb Med. 2020;50:130–34. doi: 10.28920/dhm50.2.130-134. PMID: 32557414. PMCID: PMC7481117.

2 Morgan WP, Raglin JS, O'Connor PJ. Trait anxiety predicts panic behavior in beginning scuba students. Int J Sports Med. 2004;25:314–22. doi: 10.1055/s-2004-815829. PMID: 15162252.

3 McLean CP, Anderson ER. Brave men and timid women? A review of the gender differences in fear and anxiety. Clin Psychol Rev. 2009;29:496–505. doi: 10.1016/j.cpr.2009.05.003. PMID: 19541399.

4 Nillni YI, Toufexis DJ, Rohan KJ. Anxiety sensitivity, the menstrual cycle, and panic disorder: a putative neuroendocrine and psychological interaction. Clin Psychol Rev. 2011;31:1183–91. doi: 10.1016/j.cpr.2011.07.006. PMID: 21855828. PMCID: PMC3176921.

5 Steinberg F, Doppelmayr, M. Executive functions of divers are selectively impaired at 20-meter water depth. Front Psychol. 2017;8:1000. doi: 10.3389/fpsyg.2017.01000. PMID: 28676772. PMCID: PMC5476772.

6 Zhang F, Xiao L, Gu R. Does gender matter in the relationship

between anxiety and decision-making?. Front Psychol. 2017;8:2231. doi: 10.3389/fpsyg.2017.02231. PMID: 29312077. PMCID: PMC5742200.

7 Leach J. The psychology of dysbaric environments. In: Fife CE, St Leger Dowse M, editors. Women and pressure. Diving and altitude. Flagstaff (AZ): Best Publishing Company; 2010. p. 205–14. ISBN 9781930536548.

Editorial note

The authors of reference 1 were invited to reply to this letter, but did not respond. If a response is forthcoming it will be published in a subsequent issue.

Submitted: 21 March 2021
Accepted: 24 March 2021

Michael Davis[1], John Leach[2]

[1] Department of Anaesthesiology, University of Auckland, Auckland, New Zealand
[2] Extreme Environments Research Group, University of Portsmouth, Portsmouth, United Kingdom

Address for correspondence: *Michael Davis, Department of Anaesthesiology, University of Auckland, Auckland, New Zealand.* simo01@xtra.co.nz

Key words
Letters (to the Editor); Performance; Personality; Psychology; Recreational diving; Stress; Women

doi: 10.28920/dhm51.3.306-307. PMID: 34547784.