

*Note.* This article will be published in a forthcoming issue of the *Journal of Clinical Sport Psychology*. The article appears here in its accepted, peer-reviewed form, as it was provided by the submitting author. It has not been copyedited, proofread, or formatted by the publisher.

**Section:** Original Research

**Article Title:** Flotation REST as a Stress Reduction Method: The Effects on Anxiety, Muscle Tension, and Performance

**Authors:** Marcus Börjesson<sup>1</sup>, Carolina Lundqvist<sup>2</sup>, Henrik Gustafsson<sup>2</sup>, and Paul Davis<sup>3</sup>

**Affiliations:** <sup>1</sup>Swedish National Defence College, Sweden and Karlstad University, Sweden. <sup>2</sup>Faculty of Health, Science and Technology, Karlstad University, Sweden. <sup>3</sup>Faculty of Social Sciences, Umeå University, Sweden.

**Journal:** *Journal of Clinical Sport Psychology*

**Acceptance Date:** June 14, 2017

©2018 Human Kinetics, Inc.

**DOI:** <https://doi.org/10.1123/jcsp2017-0032> .

Flotation REST as a Stress Reduction Method: The Effects on Anxiety, Muscle  
Tension, and Performance

Marcus Börjesson

Swedish National Defence College, Sweden &

Karlstad University, Sweden

Carolina Lundqvist

Faculty of Health, Science and Technology, Karlstad University, Sweden

Henrik Gustafsson

Faculty of Health, Science and Technology, Karlstad University, Sweden

Paul Davis

Faculty of Social Sciences, Umeå University, Sweden

Authors note:

Address all correspondence to Marcus Börjesson, Department of Security, Strategy  
and Leadership, Swedish Defence University, 651 80, Karlstad, Sweden. +46-708-707661  
(voice), [marcus.borjesson@fhs.se](mailto:marcus.borjesson@fhs.se).







Flotation REST interventions reviewed in mainstream psychology research have provided support for its effectiveness in various stress related conditions such as pain-relief (e.g., Bood, Sundequist, Kjellgren, Nordstrom, & Norlander, 2005, 2007), treating insomnia (e.g., Ballard, 1993), increasing positive mood states and decreasing negative mood states (see review by Suedfeld & Borrie, 1999) and as an experimental and complementary treatment of generalized anxiety disorder (Jonsson & Kjellgren, 2016). Moreover, flotation REST studies have revealed decreased general levels of stress among participants assessed by levels of stress hormones, heart rate, and blood pressure as well as enhanced perceptions of deep relaxation (e.g., Jacobs, Heilbronner, & Stanley, 1984; Schulz & Kaspar, 1994; Turner & Fine, 1983, 1991).

Within the field of sport psychology, anecdotal reports about the utility of REST for athletes first appeared in the mid-1980s (Hutchison, 1984). These reports were followed by a limited number of experimental studies investigating the effects of flotation REST, often in combination with imagery, on athletes' arousal levels, muscle tension, and/or performance (Lee & Hewitt, 1987; McAleney, Barbasz, & Barbasz, 1990; Norlander, et al., 1999; Suedfeld & Bruno, 1990; Suedfeld, Collier, & Hartnett, 1993; Wagaman, Barabasz, & Barabasz, 1991). In general, previous research has indicated that athletes perceive flotation REST as beneficial for general stress-reduction in order to increase well-being (Klockare et al., 2015). The potential efficacy of flotation REST to decrease arousal symptoms for improved athletic performance was investigated by Norlander and colleagues' (1999) in their study of archers with varying levels of proficiency. In particular, muscle tension reductions (as assessed by EMG-measurement) were found following flotation REST, and the elite level archers performed more consistently after flotation REST in comparison with their less skilled counterparts. Improved performance after flotation-REST, in comparison to control groups, was also found in studies of basketball players after one floating session (Suedfeld & Bruno,



movements disrupt the normal and automatic processes associated with successful task execution, as a result performance decrements are incurred (Beilock, Carr, MacMahon, & Starkes, 2002; Mullen & Hardy, 2000).

Several studies have indicated that following flotation REST sessions brain activity in the right hemisphere is increased (Migály, 1993; Raab & Gruzelier, 1994); an effect observed to last at least one hour (Hutchison, 1984; Norlander, Bergman, & Archer, 1998). Cognitive activity dominated by the right hemisphere of the brain is characterised by primary thought process of creativity and free-associative thinking (Neisser, 1967), thus related to autonomous processing. Thought processes dominated by the left hemisphere of the brain are instead typified by secondary thinking of analytic and reality-based thoughts (Martindale & Dailey, 1996; Norlander et al., 1999) and thus typified by conscious processing to a higher extent. Therefore, based on the conscious processing hypothesis it seems plausible that flotation REST may positively augment skilled athletes' performance due to it facilitating cognitive processes in the right hemisphere that increase automatic processing of information. Furthermore, according to the same line of theoretical reasoning, less skilled performers would conversely experience detrimental effects on performance because they require conscious control of movements associated with successful task execution. Although these suggestions appear to be theoretically plausible, further empirical research is necessary to provide evidence in support of these hypotheses that are attempting to identify the underpinning mechanisms of flotation REST's influence on sport performance.

The majority of studies on athletes' competitive anxiety within sport psychology research have heavily relied on the use of self-report measures. Self-report data combined with physiological measures of arousal have been adopted to a lesser extent (e.g., Mateo, Blasco-Lafarga, Martinez-Navarro, Guzman, & Zabala, 2011; Woodman & Davis, 2008). Moreover, cross-sectional research designs dominate the stress and anxiety literature in preference of







## Study Design and Procedure

The present study employed an experimental design with two randomized treatments. Participants were informed that they would undertake a putting competition and that the study’s design incorporated a flotation REST and an Armchair relaxation treatment. They were also informed that physiological responses and muscle tension (EMG responses) would be registered along with self-rated anxiety. To increase the competitive pressure in the experimental situation, the participants in each group were informed that they would be competing for a prize of 3000 SEK (approximately 425 USD). A visible video camera was also placed in the experimental arena and the participants were informed that an observer was registering their behaviour and reactions during the competition. However, the presence of the video camera was an additional attempt to induce the anxiety levels of participants’; this manipulation was explained to participants at the termination of the experimental protocol.

**Experimental and control condition.** The experimental condition consisted of the participants lying in the floatation tank for 45 minutes while the control condition consisted of participants sitting in an armchair reading the newspaper for 45 minutes. Immediately pre and post the flotation REST and armchair condition, the participants were instructed to lie down on a mattress for five minutes and their heart rate and blood pressure were assessed. Ten minutes prior to the putting task, participants also completed the anxiety scales of the CSAI-2.

The participant was thereafter shown to the experimental indoor arena where the putting competition was to take place in groups of two to three persons, and the golfer was then prepared for EMG-measurements. The putting task required participants to execute straight golf putts towards a circular target (2.5 x 2.5 cm), from varying distances at a flat surface. The targets were marked out in white and green artificial indoor mat (1.2 x 6 m). The golfers performed putts in a consecutive order from 2, 3 and finally 4 meters in distance; this was repeated four times giving a total number of twelve putts. Performance on the putting task was







across the two skill levels or the two relaxation conditions. It should be noted that few studies to date have indicated that performance actually is improved through the use of relaxation techniques exclusively (Fletcher & Hanton, 2001; Pelka et al., 2016). In some instances, it has been observed that deep relaxation may exert a greater adverse influence upon performance than anxiety (Neil, Mellalieu, & Hanton, 2006).

The theoretical underpinnings of mindfulness and acceptance approaches (e.g., Hayes, Strosahl, & Wilson, 2012; Gardner & Moore, 2006, 2007) state that experiential avoidance (i.e., efforts to eliminate, avoid, or control distressful inner experiences such as anxiety) often paradoxically increase the experiences the person tries to avoid (Woodman & Davis, 2008). Thus, techniques aimed to reduce or eliminate anxiety in competitive situation have been criticized for lacking empirical support for their efficacy (e.g., Moore, 2009). In contrast, techniques focused on acceptance of emotions as internal and natural competitive states and promotion of an external task relevant attentional focus as well as a flexible repertoire of behaviors, have received increased empirical support (Gardner & Moore, 2012; Sappington & Longshore, 2015). Thus, the results in the present study, when considered in relation to previous literature on relaxation, anxiety, and performance, cannot provide support for the assumption that the acute effects of flotation REST in themselves would facilitate performance in golfers of varying skill-levels.

In review of the findings of the current study in conjunction with previous research, further investigation of the influence of flotation REST upon anxiety under different performance conditions is warranted. In particular, examination of how the complexity of task demands may interact with outcomes and performers' expertise may be the focus of future studies. Additionally, it is important to further address the proposal that flotation REST may induce right hemisphere dominance and thereby strengthen automatic processing (Martindale & Dailey, 1996; Norlander et al., 1999); this suggestion is plausible as it may facilitate training

and thereby lead to improved performance in the longer term. Moreover, studies examining flotation REST with a longitudinal design and with greater ecological validity are needed as they may generate more insightful results with wider applied implications.

The present study has certain limitations that are to be acknowledged. The experimental competition situation was designed in review and replication of previous studies (e.g., Bell & Hardy, 2009; Hardy, Mullen, & Jones, 1996; Masters, 1992), wherein the application of similar stressors proved effective in inducing anxiety during golf putting protocols. Nevertheless, there was an absence of a non-treatment condition (i.e., no relaxation time provided) that would have allowed the examination of the extent to which the experimental competitive situation influenced participants' anxiety. Analysis of the golfers' subjective experience of anxiety (i.e., cognitive and somatic anxiety) indicates that the intensity of anxiety reported was markedly lower than several previous studies investigating pre-competition anxiety (e.g., Hanton, Thomas & Maynard, 2004; Jones, Hanton & Swain, 1994); this may reflect the efficacy of the relaxation treatments, but may also suggest that the test conditions only affected participants' anxiety to a small extent. Thus, the reader is encouraged to interpret the findings in light of these limitations.

In sum, the findings of the present study suggest that flotation REST may decrease physiological symptoms of stress and reports of cognitive and somatic anxiety. However, these positive results are no more efficacious than the acute effect of less advanced relaxation methods and offer no facilitating effects on performance. High-level competitive athletes are often exposed to situations comprised of potentially stressful hazards (Hanton, et al., 2005; Noblet & Gifford, 2002) that can have implications for their success and related attempts at task execution. Of particular importance to sport scientists, coaches, and athletes is the establishment of the relative effectiveness (and ineffectiveness) of various methods available to augment performance; with this in mind, flotation REST offers a relaxation method for

reducing physical symptoms linked to stress and anxiety as well as decreasing the intensity of somatic anxiety. Although these effects were not conducive to putting precision in the present study, flotation REST may be best suited for enhancing recovery between performances. That is, individuals may cope with and prepare for emotions arising during competition or work situations in a state of deep relaxation, and thereby prevent negative states such as overreaching, overtraining syndrome and burnout (e.g., Klockare et al., 2015). Whereas the long-term effects of flotation REST may be relevant from a well-being and health perspective practitioners of the method should be aware of that the acute effects in a performance situation may be fundamentally different and plausible also counterproductive to performance.



- Grossbard, J. R., Smith, R. E., Smoll, F. L., & Cumming, S. P. (2009). Competitive anxiety in young athletes: Differentiating somatic anxiety, worry, and concentration disruption. *Anxiety, Stress, & Coping, 22*, 153-166. doi:10.1080/10615800802020643.
- Hanton, S., Fletcher, D., & Coughlan, G. (2005). Stress in elite sport performers: A comparative study of competitive and organizational stressors. *Journal of Sports Sciences, 23*(10), 1129-1141. doi:10.1080/02640410500131480
- Hanton, S., Thomas, O., & Maynard, I. (2004). Competitive anxiety responses in the week leading up to competition: the role of intensity, direction and frequency dimensions. *Psychology of Sport and Exercise, 5*, 169-181. doi: 2048/10.1016/S1469-0292(02)00042-0.
- Hardy, L., Mullen, R., & Jones, G. (1996). Knowledge and conscious control of motor actions under stress. *British journal of psychology, 87*, 621-636. doi: 10.1111/j.2044-8295.1996.tb02612.x
- Hayes, S.C., Strosahl, K.D., & Wilson, K.G. (2012). *Acceptance and Commitment Therapy. The process and practice of mindful change* (2<sup>nd</sup> ed.), New York: The Guilford Press.
- Hutchison, M. (1984). *The book of floating: Exploring the private sea*. New York: Morrow.
- Jacobs, G. D., Heilbronner, R. L., & Stanley, J. M. (1984). The effects of short-term flotation REST on relaxation: a controlled study. *Healthy Psychology, 3*, 99-111. doi: 10.1037/0278-6133.3.2.99
- Janson, L., Archer, T., & Norlander, T. (2003). Timing in sports performance: Psychophysiological analysis of technique in male and female athletes. *Athletic insight, 5* (4). Retrieved December 14, 2005, from <http://athleticinsight.com/Vol5Iss4/Timing.htm>.
- Jones, G., Hanton, S., & Swain, A. B. J. (1994). Intensity and interpretation of anxiety symptoms in elite and nonelite sports performers. *Personality and Individual Differences, 17*, 657-663.
- Jones, G., & Hanton, S. (2001). Pre-competitive feeling states and directional anxiety interpretations. *Journal of Sports Sciences, 19*, 385-395. doi:10.1080/026404101300149348.
- Jones, M.V., & Uphill, M. (2004). Responses to the competitive state anxiety inventory-2 (d) by athletes in anxious and excited scenarios. *Psychology of Sport and Exercise, 5*, 201-212. doi:10.1016/S1469-0292(02)00054-7.
- Jonsson, K., & Kjellgren, A. (2016). Promising effects on treatment with flotation-REST (restricted environmental stimulation technique) as an intervention for generalized anxiety disorder (GAD): a randomized controlled pilot trial. *Complementary and Alternative Medicine, 16*, 108. doi: 10.1186/s12906-016-1089-x
- Klockare, E., Gustafsson, H., Davis, P., & Lundqvist, C. (2015). Track and field athletes' experiences and perceived effects of flotation-Rest: An interpretative phenomenological analysis. *International Journal of Sport Psychology, 46*, 409-428.





- Suedfeld, P., Collier, D.E., & Harnett, B.D.G. (1993). Enhancing perceptual-motor accuracy through flotation REST. *The Sport Psychologist, 7*, 151-159.
- Turner, J.W.Jr., & Fine, T.H. (1991). Restricting environmental stimulation influences levels and variability of plasma cortisol. *Journal of Applied Physiology, 70*, 2010-2013.
- Turner, J.W.Jr., & Fine, T.H. (1983). Effects of relaxation associated with brief restricted environmental stimulation therapy (REST) on plasma cortisol, ACTH och LH. *Biofeedback and Self-Regulation, 8*, 115-126.
- van Dierendonck, D., & Nijenhuis, J.T. (2005). Flotation restricted environmental stimulation therapy (REST) as a stress-management tool: A meta-analysis. *Psychology and Health, 20*, 405-412. doi: 10.1080/08870440412331337093
- Wagaman, J., Barabasz, A., & Barabasz, M. (1991). Flotation REST and imagery in the improvement of collegiate basketball performance. *Perceptual and Motor Skills, 72*, 119-122. doi: 10.2466/PMS.72.1.119-122
- Weinberg, R. S. (2010). Activation/arousal control. In S. J. Hanrahan & M. B. Andersen (Eds.), *Routledge handbook of applied sport psychology* (pp. 471-480). New York: Routledge.
- Woodman, T., & Davis, P. A. (2008). The role of repression in the incidence of ironic errors. *The Sport Psychologist, 22*, 183-196.
- Woodman, T., & Hardy, L. (2001). *Stress and anxiety*. In R. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of research on sport psychology* (2<sup>nd</sup> ed.; pp. 290-318). New York: Wiley.



