


Psychophysiological responses to competition among university swimmers

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ABSTRACT

This study investigated anticipatory cortisol and pre-competitive anxiety of swimmers before competition. Fifteen university swimmers volunteered to participate in the study. Salivary cortisol and Competitive State Anxiety Inventory-2 (CSAI-2R) were collected six days (6d) and two hours (2h) before competition. Results revealed higher somatic anxiety 2h compared to 6d prior to competition. No differences were observed in cortisol, cognitive anxiety, and self-confidence. Thus, somatic anxiety of swimmers increase in response to competition.

Keywords: Anticipatory cortisol; Anxiety; Athletic performance; Swimmers.

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INTRODUCTION

Cortisol has been widely used as a biomarker of stress (Hellhammer, Wüst, & Kudielka, 2009). Indeed, researchers demonstrated changes in cortisol in response to competition (Alix-Sy, Le Scanff, & Filaire, 2008; Filaire, Alix, Ferrand, & Verger, 2009; Filaire et al., 2001; Kim, Chung, Park, & Shin, 2009; Pakulanon & Poomsalood, 2012; Salvador, Suay, González-Bono, & Serrano, 2003). Filaire et al. (2001) posted increased cortisol in competitive event among judo athletes. Similarly, Salvador et al. (2003) also noted escalation in cortisol in competition. Alix-Sy, Le Scanff, & Filaire (2008) displayed higher cortisol during pre-competition in football players. Filaire et al. (2009) showed increased cortisol response with competition among tennis players. Kim et al. (2009) recorded increased cortisol prior to and after competition in golfers. With sport dancers, Pakulanon & Poomsalood (2012) presented rise in cortisol in competition. Thus, stress level arising from competition is supported by increasing cortisol.

Competitive anxiety has also been reported to increase with competition (Arruda, Aoki, Paludo, & Moreira, 2017; Strahler, Ehrlenspiel, Heene, & Brand, 2010). For example, Strahler et al. (2010) posted increased somatic anxiety of German combat sports athletes nearing competition. Arruda et al. (2017) also reported competitive anxiety to increase with competition of elite basketball players. Duncan et al. (2016) found higher anxiety in competitive conditions when compared to practice among physical active adults.

Understanding psychophysiological responses to competition can aid in implementation of various schemes to assist athletes in training. However, there seems to be limited literature investigating quantitative and subjective measures of stress. Thus, the purpose of this study was to investigate the cortisol and competitive anxiety among university swimmers.

MATERIALS AND METHODS

Subjects

Subjects of this study consisted of 15 male and female swimmers (age: 18.5 ± 1.70 yrs.; weight: 61.0 ± 6.30 kg; height: 163.6 ± 7.30 centimetres; and %body fat: 16.0 ± 6.40) from a public university in the Philippines. The participants have no known history of drug intake and endocrine disorders that could affect hormonal levels in the time of the study. Subjects were limited to engage only on light to moderate exercise, 24 hours prior to sampling. Subjects abstained for 12 hours from alcohol, nicotine and caffeine and fasted for at least 2 hours prior to sampling. A written informed consent submitted by athletes prior to further participation. The experimentation protocol adhere to the guidelines of Declaration of Helsinki for Human Experimentation.

Procedures

Experimentation occurred for two sessions separated by 6 days at 0600-0630 hrs. located at the training facility and competition area respectively. Saliva sample collection was succeeded by completion of Competitive State Anxiety Inventory Scale (CSAI-2R).

Salivary cortisol

Saliva samples were collected using SalivaBio Oral Swabs (SALIMETRICS, LLC) prior to toothbrush to avoid potential blood contamination. Samples underwent centrifugation and frozen at -20 °C until determination. The duplicate samples from each subject were tested in the same assay. Preparation of calibrators, diluted conjugates, wash solutions and sample, and hormonal determinations were conducted by Enzyme-linked immunosorbent assay (ELISA) in the Protein Structure and Immunology Laboratory of the National Institute of Molecular Biology and Biotechnology at the University of the Philippines- Diliman. ELISA method detects

proteins, peptides, hormones, or antibodies in fluid samples (Ghosal & Srivastava, 2009). This technique utilizes antibodies to bind to the target proteins, reflecting an enzyme-mediated colour change, allowing quantitative and qualitative measurement of even very small quantities of the target proteins, peptides, hormones, or antibodies (Gan & Patel, 2013). The salivary C concentrations were expressed in nanograms per millilitres (ng/mL).

Competitive State Anxiety Inventory-2 (CSAI-2R)

The CSAI-2R is a 17 item questionnaire that measures 3 subscales: somatic anxiety, cognitive anxiety, and self-confidence. Each item was set to a 4-point Likert scale. Subscale score was obtained by getting the sum of the scores for each item, dividing the sum by the number of items, and multiplying the resulting quotient by 10. The items that were totalled for the somatic anxiety score were items 1, 4, 6, 9, 12, 15, and 17. For cognitive anxiety, the items were 2, 5, 8, 11, and 14. For self-confidence, the items were 3, 7, 10, 13, and 16. Score range was 10 to 40 for each subscale. Score of subjects that failed to respond to an item was merely divided by the number of items answered.

Statistical analysis

Data are expressed as mean \pm standard deviation. Paired T-test was carried out to establish any significant difference between 6d and 2h before competition. Significance was set at .05 level.

RESULTS

Paired T-test revealed non-significant difference in C before and during competition, $t(14) = -1.21, p = .25$. There was a significant difference in somatic anxiety 6d and 2h before competition, $t(14) = -4.70, p = .00$. No difference was detected in cognitive anxiety 6d and 2h prior to competition, $t(14) = -0.97, p = .35$. Similarly, self-confidence was not significantly different 6d and 2h prior to competition, $t(14) = 0.38, p = .71$. Table 1 displays the psychophysiological variables 6d and 2h before competition.

Table 1. Psychophysiological indices prior to competition.

	6d	2h	p-value
Cortisol (ng/ml)	1.51 \pm 0.89	3.05 \pm 5.08	.25
Somatic Anxiety	17.3 \pm 7.31	24.1 \pm 5.83	.00
Cognitive Anxiety	27.6 \pm 7.57	29.1 \pm 5.44	.35
Self-Confidence	24.8 \pm 5.74	24.3 \pm 6.09	.71

DISCUSSION

The purpose of this study was to examine the cortisol and pre-competitive anxiety of athletes in response to competition. Results revealed higher somatic anxiety 2h nearing competition. Other findings demonstrated non-significant difference in cortisol, cognitive anxiety, and self-confidence.

Indeed, somatic anxiety of swimmers increase with time nearing competition. This finding is in accordance with previous evidence of increased somatic anxiety with competition. (Ferreira, Chatzisarantis, Caspar, Campos, 2007; Campbell & Jones, 1997; Fortes, et al, 2017). The increased somatic anxiety can be attributed to psychological skills of athletes (Pollman & Schack, 2017). It may also be possible that the competition is perceived to be a highly stressful event (Hagan, Pollman, & Schack, 2017). In relation to this, maintenance of social hierarchy and perception of competition as a challenging environment may have

contributed to increased somatic anxiety. Future studies should examine potential factors contributing to escalation of somatic anxiety with competition.

In this study, cortisol was not affected 6d and 2h prior to competition. However, there is a notable increasing cortisol concentration from 6d to 2h before competition. This is somehow consistent with the results exhibited by Filaire et al. (2001). The increased cortisol implies stimulation of the autonomic nervous system prior the competition which enables coping with the psychological and physiological demands of the competition (Arthur, 1987).

Swimmers depicted non-difference in cognitive anxiety. Although non-significant findings were reported, there is a tendency of cognitive anxiety to increase with competition. This finding is somehow similar to the results posted Hanton et al. (2002) which demonstrated increased cognitive anxiety nearing competitive event. Thus, interventions reducing cognitive anxiety are needed to address the psychological demands of competition.

Within this study, the time-difference prior to competition did not influence the self-confidence of the swimmers. This result was non-coherent with the findings from previous researchers that reported reduction in self-confidence nearing competition (Serrano, Salvador, González-Bono, Sanchís, & Suay, 2000; Filaire et.al., 2009; Pakulanon & Poomsalood, 2012). The non-effect in self-confidence 6d and 2d before competition may be linked to competitive playing experience and perceived efficiency in training preparations.

Limitations of this study are acknowledged. First, generalizability of the results should be avoided as the findings are only applicable to the participants of this study. Second, inclusion of other measures (e.g., sleep habits, heart rate variability) can provide information on contributory factors to somatic anxiety. Lastly, increasing sample size will add meaningful inference on establishing the relationship of cortisol and competitive anxiety.

In conclusion, approaching competition increased somatic anxiety among university swimmers. Future studies should examine strategies towards reduction of somatic anxiety in response to competition.

AUTHOR CONTRIBUTIONS

Portia Heidi Mendoza-Balite: 1, conception and study design; 2, data gathering; 3, data analysis and interpretation; 4, manuscript draft, revision, and completion. Jeffrey Pagaduan: 1, data analysis and interpretation; 2, manuscript draft, revision, and completion. Percival Henry Mendoza-Balite and Marcus Jarwin Ani-Manalo: 1, manuscript draft, revision, and completion.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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