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Levels of Anxiety: Practice vs. Competition among NCAA Division I Women Gymnasts

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Abstract Prior to competition somatic and cognitive state anxiety levels can increase leading to a decrease in performance and increase in injury risk. Identifying situations that could cause high levels of anxiety are important so proper anxiety management techniques can be used. **PURPOSE:** The purpose of this study was to compare levels of somatic and cognitive anxiety as well as self-confidence in collegiate gymnasts prior to a pre-practice and pre-competition like scenario. **METHODS:** One NCAA Division I Gymnastics Team (n=17) completed the Competitive State Anxiety Inventory-2 (CSAI-2) survey prior to a practice and again prior to a competition setting. The CSAI-2 contains three subscales (cognitive anxiety, somatic anxiety, and self-confidence). The CSAI-2 subscale scores were compared between the pre-practice and the pre-competition scenarios with paired t-tests ($\alpha<0.05$). **RESULTS:** No statistical differences in the subscale scores (cognitive anxiety, somatic anxiety, and self-confidence) were found between the practice and the competition scenarios ($p>0.05$). **CONCLUSIONS:** Within the parameters of this study, anxiety and self-confidence levels appear consistent between practice and competitive scenarios among collegiate gymnasts.

Keywords CSAI-2, Women gymnastics, Performance anxiety, Pre-practice, Pre-competition

1. Introduction

Anxiety is defined as an emotion that is felt when facing uncertain threats and is considered to be one of the most important psychological determinants of sport performance [5,9]. Anxiety is multidimensional by nature and may manifest as somatic anxiety and/or cognitive anxiety [5]. Cognitive anxiety refers to an athlete's mental thoughts or concerns about the performance or competition [3]. Somatic anxiety refers to common physical symptoms of anxiety including increased heart rate, sweating, uncontrolled muscular tension, shaky hands, butterflies in the stomach, and/or rapid breathing [6,13,18]. Somatic and cognitive anxiety can be further classified as a state or trait [5]. State anxiety is an emotional state that is felt acutely and is characterized by apprehension, fear, and increased physiological arousal [5]. Trait anxiety refers to a predisposition to where an individual feels threatened and responds with increased state anxiety [5].

Somatic and cognitive anxiety can significantly impact the performance level of athletes on competition day [5,10]. The multidimensional anxiety theory helps in understanding the relationship between anxiety and performance. It states there is a negative linear relationship with cognitive anxiety and performance, as well as, an inverted-U relationship with somatic anxiety and performance [5]. Meaning, any amount of cognitive anxiety has the potential to impair performance while low levels of somatic anxiety can result in underperformance and moderate levels of somatic anxiety can result in ideal performance, but high levels of somatic anxiety can result in underperformance. Importantly, self-confidence (SC), defined as one's feeling of trust in their ability to have a successful performance, is inversely related to cognitive and somatic state anxiety [2,5].

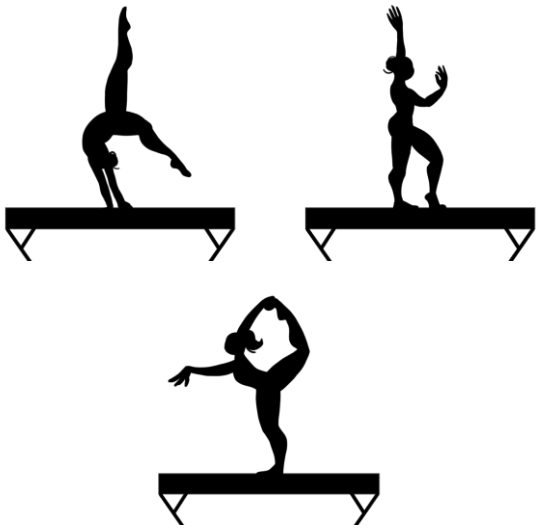

Figure 1. NCAA Women's Gymnastics (courtesy of K. Navalta)

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Determinants of state anxiety level is multifaceted. Many studies have found a significant difference in anxiety levels between younger and older athletes, male and female athletes, team and individual sport athletes, and specific competitive scenarios [2,20,21]. In a study conducted on young swimmers and water-polo athletes, aged 13-19 years old, females were found to have higher cognitive and somatic state anxiety levels pre-competition compared to male swimmers and water-polo athletes [20]. In the same study, the younger athletes demonstrated higher levels of cognitive state anxiety, while the older athletes exhibited higher levels of SC [20]. Research comparing pre-competition anxiety levels between young adult basketball players and cyclists demonstrated that basketball players exhibited high levels of SC and moderate levels of cognitive and somatic anxiety while the cyclists demonstrated low levels of cognitive and somatic anxiety and moderate levels of SC [21]. Another study among young female gymnasts (10-13 years) investigated variations in anxiety levels before performing on different apparatuses [2]. The results demonstrated a significant increase in anxiety when going from the floor to the beam, and from low beam to high beam [2]. Anxiety levels have been demonstrated to increase temporally prior to competition and decrease post competition [12,19]. An investigation of teenage male swimmers found both cognitive and somatic state anxiety increased from seven days to an hour prior to competition [12]. Similar results were found in a study conducted with athletes of the Dutch Women's Volleyball National Team. Results indicated an increase in cognitive anxiety and somatic anxiety levels before competition compared to post competition [19]. Conversely, other studies have found no significant difference in anxiety levels between positions played, competitive scenarios, or gender [1,4]. An investigation of NCAA Division I North American Football players found no significant difference in anxiety levels between competitive scenarios or position played [1]. However, based on the majority of these findings it seems reasonable to assume that measures of performance-related anxiety vary among and even within athletes, depending on the competitive environment. As such, measures of anxiety should be captured in each individual and in a variety of competition and practice environments.

Measurement of this construct is of particular relevance within athletics as high levels of anxiety have been shown to have negative effects on sports performance [14,22]. An investigation of amateur golfers found putting was significantly less accurate during high anxiety conditions compared to low anxiety conditions [14]. Similar results were found in a meta-analysis conducted by Wooden and Hardy [22]. Results from 26 studies indicated a negative relationship between cognitive anxiety and performance; however 7 studies found no significant results, and 10 actually found a positive relationship between cognitive anxiety and performance [22]. Another study conducted with university-level male table tennis athletes found no changes in serve kinematics between high anxiety (competition) and low anxiety environments (no opponent) [15]. However, researchers did not measure anxiety levels, per say, and only examined one aspect of table tennis performance so it is unclear if overall performance was affected.

Ultimately the majority of research indicates that high cognitive and somatic anxiety does reduce performance, therefore, the goal should be to reduce anxiety levels prior to competition. Research indicates mental training can help mitigate anxiety in athletes [7,8]. Mental training is defined as a process of training that can influence an athlete's mental process and personality to adjust and control their behavior by implementing ways to help their psychological state [23]. Mental training has been found to reduce cognitive and somatic anxiety among teen male swimmers following an 8-week intervention [7]. Similar results were found in a study investigating the effects of a multimodal anxiety management program (5 sessions) on the intensity and direction of cognitive anxiety, state anxiety, and self-confidence among amateur golfers (≈20 years old) [8]. The study's results suggested that the multimodal anxiety management program was effective with respect to helping amateur golfers manage cognitive anxiety direction while preventing "debilitative changes in SC direction" [8]. Given the aforementioned [7,8,23], it is reasonable to think that coaches could help athletes recognize signs of anxiety and utilize mental training in order to decrease the negative effects of anxiety on performance.

NCAA Division I Gymnastics is a popular sport and extremely competitive. Having a general knowledge of differences in anxiety levels pre-competition versus pre-practice may help guide a gymnast's use of mental training exercises in an effort to reduce anxiety levels and increase competition performance. In this context, the purpose of this study was to investigate the difference in anxiety levels between pre-competition and pre-practice scenarios. In order to conduct the study, the instrument of choice was the Competitive State Anxiety Inventory-2 (CSAI-2) [13]. The CSAI-2 was developed by Martens, Vealey, and Burton [13] and assesses constructs of cognitive state anxiety (CSA), somatic state anxiety (SSA), and SC via three subscales. It was hypothesized that the subscale scores for the CSA and SSA would be lower prior to practice compared to the competition scenario and the subscale SC score would be higher prior to practice when compared to the competition scenario.

2. Methods

Participants

The participants in this study were competitive female gymnasts from a NCAA Division I Women's gymnastics team. Only gymnasts that were competing on one or more apparatuses were permitted to participate in this study. The gymnasts ranged in age from 18 to 22 years old (n=17). The

study was conducted during the pre-season, temporally near the annual Red and White preview (an intra-squad competition).

After IRB approval (SUU IRB approval # *27-092019a*), participants were given a written informed consent form that explained the study purpose and procedures. Participants who agreed to participate completed an informed consent prior to filling out the questionnaire. No compensation was provided for participating in the study.

Instrument

The CSAI-2 questionnaire was used for this study. It includes 27 questions that assesses state anxiety in the dimensions of CSA, SSA, and SC. Each question was answered using a Likert-like scale that ranges from 1 (not at all) to 4 (very much so). All three subscales were calculated according to Martens, Vealey, and Burton [13]. After each questionnaire was calculated, the subscale scores were characterized as follows: 9 to 18 points low levels of anxiety or SC, 19 to 27 points moderate levels of anxiety or SC, and 28 to 36 points high levels of anxiety or SC [2]. The CSAI-2 has demonstrated an internal consistency across subscales of r=0.79-0.94 [11,13] and a test-retest reliability ICC=0.79-0.94 across subscales [16].

Procedures

The CSAI-2 survey was administered twice to the same athletes on two separate occasions, once prior to a practice and again prior to a competition like scenario. In both occasions, upon arriving in the locker room, the surveys (CSAI-2) and pens were provided to the gymnasts. During the first occasion, the gymnasts completed the CSAI-2 while preparing for a practice. After all surveys were completed and collected, each was scored. The scores of the subscales were then classified as previously described.

The CSAI-2 was then administered again approximately three weeks following the first administration. The same procedures were employed with the exception being that the CSAI-2 was completed just prior to a competition like scenario. Once again, the completed CSAI-2 surveys were scored and the subscales classified as during the first administration.

Environment

The two scenarios that were used in this study were a practice and a competition like scenario. The first scenario was a familiar practice that had been conducted numerous times throughout pre-season. This practice was a non-competitive environment that focused on showing individual skills in front of a crowd. The competition-like scenario was a normal pre-season competition, where the team warmed up on each event, changed into competition attire, and went back to each event for competition using the home meet rotation and a 4 minute touch warm-up. The assistant coaches and head coach judged all 6 routines on all 4 events. The competition followed all standard rules for gymnastics.

Statistical Analysis

The dependent variables in the current study were: CSA, SSA, and SC as assessed by the subscales of the CSAI-2. The independent variable in the current study was environment (pre-practice and pre-competition). The dependent variables were compared between the two environmental conditions with one-tailed dependent t-tests. Statistical analysis was conducted with MS Excel 2016. Statistical significance was considered as $\alpha \leq 0.05$.

3. Results

Seventeen female Division I NCAA gymnasts completed the study. Table 1 and 2 represents the percentage of athletes that showed low, moderate, and high levels of CSA, SSA, and SC prior to practice and the competition like scenario.

Table 3 provides the mean and standard deviation of the CSAI-2 subscale scores prior to practice and the competition like scenario. Likewise, the resulting p-values of the pairwise comparisons of the subscale scores between environmental conditions are provided. No significant differences were found for any of the subscale scores between the environmental conditions ($p>0.05$).

The Cronbach's α of the CSAI-2 subscales ranged from 0.79-0.86 and is consistent with prior research [11,13,17].

Table 1. Competitive State Anxiety Inventory-2 (CSAI-2) Pre-Practice (n=17)

Subscales	Low	Moderate	High
CSA	82%	18%	0%
SSA	88%	12%	0%
SC	0%	24%	76%

Percentages for cognitive state anxiety (CSA), somatic state anxiety (SSA), and self-confidence (SC) prior to the practice scenario.

Table 2. Competitive State Anxiety Inventory-2 (CSAI-2) Pre-Competition (n=17)

Subscales	Low	Moderate	High
CSA	88%	12%	0%
SSA	100%	0%	0%
SC	6%	18%	76%

Percentages for cognitive state anxiety (CSA), somatic state anxiety (SSA), and self-confidence (SC) prior to the competition like scenario.

Table 3. Competitive State Anxiety Inventory-2 (CSAI-2) Scores (n=17)

	CSA	SSA	SC
Pre-practice	15.1±4.3	13.9±3.3	30.1±3.7
Pre-competition	15.2±6.4	13.0±2.8	29.3±6.2
p-value	0.47	0.22	0.35

Mean±Standard Deviation (SD) for cognitive state anxiety (CSA), somatic state anxiety (SSA), and self-confidence (SC). No significant differences between pre-practice and pre-competition scenarios ($p>0.05$).

4. Discussion

The purpose of the current study was to determine if there was a difference in CSA, SSA or SC between pre-practice and pre-competition scenarios among NCAA Division I women gymnasts using the CSAI-2 questionnaire on two separate occasions: pre-practice and pre-competition scenarios. It was hypothesized that there would be a significant difference in measures of anxiety and SC between the two scenarios. The results for this study did not support the research hypothesis.

There were no statistical differences in CSA, SSA, and SC between pre-practice and pre-competition scenarios ($p>0.05$). Prior to the pre-practice scenario 82-88% of the gymnasts expressed low levels of CSA or SSA and 76% conveyed high levels of SC. Prior to the pre-competition scenario 88-100% of the gymnasts expressed low levels of CSA or SSA and 76% expressed high levels of SC. It is counter intuitive that the percent of those scoring as low for the CSA and SSA increased prior to a competitive scenario. We have no firm explanation for this phenomena; however, there are several speculative explanations. It is possible that the gymnasts did not view the pre-competition scenario in the same way as an actual competitive meet. It is also possible that the coaches of these athletes are extremely good at mentally preparing their athletes for competition. Additionally, it is possible they were attempting more difficult routines in practice compared to competition. Finally, given the pre-practice survey was administered three weeks prior to the pre-competition survey, it is possible that the gymnasts had improved on or mastered their respective routines, thereby increasing SC and reducing anxiety.

In the current study higher CSA and SSA were associated with lower SC. Specifically, the Pearson correlation coefficients (PCCs or r) were as follows: CSA and SC r= -0.70; SSA and SC r= -0.46. These results are in agreement with other studies that found SC to be inversely related to both CSA and SSA [2,17]. An investigation by Reid and colleagues [17] reported similar PCCs: CSA and SC r= -0.74; SSA and SC r= -0.45 as assessed by the CSAI-2 among preadolescent competitive female gymnasts prior to a competition. Additionally, a study of young gymnasts indicated changes in cognitive anxiety and SC when in differing environments [2]. Researchers found when gymnasts performed a cartwheel on the floor, a relatively simple task, cognitive anxiety was low while SC was high. However, when gymnasts performed the same exercise on the high beam they were reported to have medium levels of cognitive anxiety and lower levels of SC.

The results of the current study are in direct contrast to prior research indicating that competitive scenarios increase anxiety and reduce SC [12,17,19]. Reid and colleagues [17] investigated CSA, SSA and SC between pre-practice and pre-competition scenarios among preadolescent competitive female gymnasts. Reid et al. [17] concluded, "The results suggest that anxiety and SC shift to a less favorable state prior to a competition setting". Likewise, investigations of teenage male swimmers (individual co-actional sport) [12] and elite women volleyball players (collective interactional sport) [19] have shown an increase in both cognitive and somatic anxiety prior to competition (noting that gymnastics is an individual co-actional sport). In opposition, other studies have found no significant difference in anxiety levels prior to competitive scenarios. Allie at al. [1] found no significant difference in anxiety levels between competitive scenarios or positions played among NCAA Division I North American Football players. Further, an investigation of university-level table tennis players demonstrated no changes in serve kinematics between high anxiety (competition) and low anxiety scenarios (no opponent) [15].

The results of the current study may be related to the development and age of the athletes. Studies have indicated age can influence SC [20]. Thanopoulos and Platanou [20] conducted a study examining anxiety and SC between age groups and genders among young swimmers and water polo athletes. The younger age group (13-15 years) had higher CSA scores compared to the older age group (16-19 years), who scored higher on measures of SC [20]. The aforementioned age related phenomena could indicate why, in the present study, there were high levels of SC and low levels of anxiety in both scenarios (average age of gymnasts was ~20 years). As such, they were likely to have higher levels of SC and lower anxiety levels than younger, less experienced gymnasts regardless of the environment.

CSA, SSA and SC subscale scored have been shown to be related to athletic performance [2,5,9,10]. While the current study did not assess performance, there is no reason to believe that the aforementioned relationship between CSA, SSA, SC and performance does not hold true for collegiate gymnasts. While the research hypothesis was not supported in the current study, it is still important for coaches and athletes to develop an awareness of the relationship between anxiety, SC and performance. Knowledge of an athlete's anxiety and SC levels in various environments may be beneficial for coaches and gymnasts when developing and implementing mental training strategies intended to improve performance in the competitive environment.

There were various limitations to this study. As is the limitation with all self-reported data, participants were assumed to have completed the questionnaire with honesty and accurate interpretation of the questions being asked. Additionally, this study was carried out with a small convenience sample from one NCAA Division I team and these athletes may or may not be representative of other collegiate gymnasts. The study timing and environments also pose limitations to the generalization of its results. Specifically, surveys were administered to gymnasts prior to a pre-season competition scenario and not prior to an in-season competition. It is possible that this competition like scenario may not have simulated the emotions of an in-season competition. Additionally, the environments of the competition like scenario and practice scenario were not entirely similar to an actual competition or practice. In the pre-competition scenario there were only familiar faces

judging the gymnast and no audience was present while the pre-practice scenario was not in the usual practice facility, it was held in the competition arena with a crowd watching, possibly increasing anxiety levels. Future studies may resolve these limitations by having a larger and more diverse sample, surveying gymnasts prior to a practice in their facility without an audience, and conducting the pre-competition survey prior to an in-season meet that is highly competitive. Likewise, future research should attempt to directly relate CSAI-2 subscale assessments with actual individual gymnastic competition scores. Finally, while prior research has suggested no differences between genders with regards to state anxiety among adult amateur athletes [4], we suggest that similar studies should be carried out with male gymnasts.

5. Conclusions

Within the parameters of this study, there was no significant difference in CSA, SSA, or SC between pre-practice and pre-competition scenarios among female Division I NCAA gymnasts.

REFERENCES

[1] Allie J., Larson A., & DeBeliso M. (2018). Levels of anxiety: practice vs competition in NCAA division I North American football players. *International Journal of Sports Science, 8(4),* 118-123.

[2] Barreto, P. M., De Morases, M. G., De Souza Zanini, G., Neiva, C. M., Vilela Terra, G. D. S., Filho, D. M. P., … Lopes Veradi, C. E. (2016). Associated factors between the state of anxiety and a specific gymnastics skill with environmental variations. *Journal of Physical Education & Sport, 16*(1), 187–191.

[3] Borkovec, T. D. (1976). Physiological and cognitive processes in the regulation of anxiety. In G. E. Schwartz and D. Shapiro. (Eds.). *Consciousness and self-regulation: Advances in research* (Vol.1). New York, NY: Plenum.

[4] Cemil, A., Nazmi, S., & Betül, C. (2016). The comparison of anxiety level between male and female athletes in amateur teams. *Ovidius University Annals, Series Physical Education & Sport/Science, Movement & Health, 16,* 280–284.

[5] Cox, R. H. (2012). *Sport psychology: Concepts and applications* (7th ed.). New York: McGraw-Hill.

[6] Davidson, R.J., & Schwartz, G. E. (1976). The psychobiology of relaxation and related states: A multi-process theory. In D. I. Mostofsky (Ed.), *Behavior control and modification of physiological activity* (pp. 399-442). Englewood Cliffs, NJ: Prentice-Hall.

[7] Fortes, L. D. S., Lira, H. A. A. D. S., Lima, R. C. R. D., Almeida, S. S., & Ferreira, M. E. C. (2016). Mental training generates positive effect on competitive anxiety of young swimmers? *Revista Brasileira de Cineantropometria & Desempenho Humano, 18*(3), 353-361.

[8] Grobbelaar, H. W., Duthie, K. R., & Fanton, E. R. (2018). Effect of a group multimodal anxiety management programme on competitive state anxiety and self-confidence of amateur golfers. *South African Journal for Research in Sport, Physical Education & Recreation, 40*(2), 69–80.

[9] Hanin, Y. L. (2000). Individual zones of optimal functioning (IZOF) model: Emotion- performance relationships in sport. In Y.L. Hanin (Ed.), *Emotions in sport* (pp. 65-89). Champaign, IL: Human Kinetics.

[10] Horikawa M., and Yagi A. (2012). The relationships among trait anxiety, state anxiety and the goal performance of penalty shoot-out by university soccer players". *PlosONE* 7 (4), 1-5.

[11] Jones, G., & Hanton, S. (2001). Pre-competitive feeling states and directional anxiety interpretations. *Journal of Sport Sciences, 19*(6), 385-395.

[12] Mabweazara, S. Z., Andrews, B. S., & Leach, L. L. (2014). Changes in state anxiety prior to competition. *African Journal for Physical, Health Education, Recreation & Dance, 20*(2.1), 492–499.

[13] Martens, R., Vealey, R.S., and Burton, D. (1990). *Competitive anxiety in sport.* Champaign, IL: Human Kinetics.

[14] Mullen, R., Hardy, L., & Tattersall, A. (2005) The Effects of Anxiety on Motor Performance: A Test of the Conscious Processing Hypothesis. *Journal of Sport & Exercise Psychology, 27*(2), 212.

[15] Ngo, V., Richards, H., & Kondric, M. (2017). A multidisciplinary investigation of the effects of competitive state anxiety on serve kinematics in table Tennis. *Journal of Human Kinetics, 55*(1), 83–95.

[16] Reid, C. & DeBeliso, M. (2019). The reliability of the CSAI-2 among preadolescent female gymnasts: pilot study short report. *Journal of Physical Education Research, 6*(3), 9-17.

[17] Reid, C., Larson, A., & DeBeliso, M. (2020). Pre-practice and pre-competition state anxiety among preadolescent female gymnasts: A pilot study. *Journal of Physical Education Research, 7*(1), 9-19.

[18] Roberts, G. C., Spink, K. S., & Pemberton, C. L. (1999). *Learning experiences in sport psychology* (2nd ed.). Champaign, IL: Human Kinetics.

[19] Sekeroglu, M. Ö. (2017). Examining the pre- and post-competition state anxiety levels of sportswomen of the Dutch Women's Volleyball National Team. *Journal of Education and Training Studies, 5*(13), 37–43.

[20] Thanopoulos, V., & Platanou, T. (2016). Pre-competitive anxiety in swimmers and water polo players in relation to gender and age. *Facta Universitatis: Series Physical Education & Sport, 14*(3), 347–354.

[21] Vardo, E., & Ahmić, D. (2016). Comparative analysis of competition anxiety of Bosnian and Herzegovinian athletes in relation to the type of Sport. *Sport Scientific & Practical Aspects, 13*(1), 37–41.

[22] Woodman, T., Hardy, L. (2003). The relative impact of cognitive anxiety and self-confidence upon sport performance: a meta-analysis. *Journal of Sports Sciences, 21*(6), 443.

[23] Xiong, J. (2012). The functions and methods of mental training on competitive sports. *Physics Procedia, 33*, 2011-2014.