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THE IMPACT OF COMPETITIVE TRAIT ANXIETY ON COLLEGIATE POWERLIFTING PERFORMANCE

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ABSTRACT

The purpose of this study was to determine the relationship between competitive trait anxiety measures and powerlifting (PL) performance. Thirty-six collegiate powerlifters on club teams from three universities were recruited during a competition (Male = 26, Female =10; Age 19.9 +/- 1.5yrs; Height 172.5+/- 8.6cm; Weight 81.4+/- 21.0kg). The athletes were distributed across weight classes for collegiate PL (47.6kg: 1; 51.7kg: 1; 54.9kg: 1; 59.8kg: 3; 67.1kg: 2; 74.8kg: 7; 82.1kg: 4; 89.8kg: 9; 99.8kg: 5; SHW: 3). A survey containing questions about powerlifting performance history and the 15-item Sport Competition Anxiety Test (SCAT) were administered to the participants prior to competing. The SCAT total was negatively correlated (r = -.397, p = 0.02) to the athletes' percentage of best total achieved in the competition (Actual Performance Total/Best Comp Total *100). Of the individual lifts, the SCAT score was negatively correlated to the personal best for bench press (r = -0.368, p = 0.03) and deadlift (r = -.317, p = 0.05), but did not significantly correlate for squat (r = -0.182, p = 0.27). These results indicate a negative correlation between SCAT score and athletes' personal best total in PL. Increased SCAT scores were associated with decreased personal best PL totals. The results suggest competitive trait anxiety may have negatively impacted performance and suggests some PL athletes may benefit from interventions aimed at decreasing anxiety prior to and during performance.

Key words: arousal, competition, strength

INTRODUCTION

Powerlifting is an international sport where competitors attempt to lift a maximum amount of weight in three primary lifts: the bench press, the squat, and the deadlift. These three lifts provide widely accepted measures of upper body, lower body, and total body strength (3). In the United States, powerlifting is a club sport at many universities, and most powerlifters are either open competitors or recreational athletes who compete at local or regional meets. Collectively, these various competitive levels create a broad pool of participants for this sport. At all levels of powerlifting, each competing athlete is ranked based upon the best of the three valid attempts afforded for the bench press, squat, and deadlift. The three are then "totaled," providing a measure of the total weight lifted and determining each athlete's overall place in the competition.

Skillful execution of each of the three afforded lifts for the bench press, squat, and deadlift during competition can be influenced by the subjects' psychological state, such as their perception of the situation as challenging versus threatening (4, 5). Previous research has suggested that competitive trait anxiety, defined as the tendency to respond to competitive situations as threatening (10), is greater in individual sports (such as powerlifting) than in team sports (26). While the term "anxiety" is commonly associated with unpleasantness and considered a pejorative term, some athletes experience positive rather than negative pre-performance stress (17). Prior to competition, powerlifting athletes have time to compare themselves to their competitors, as they are all warming up in the same pre-competition area. If athletes are confident that they can win, such comparison can increase individual assurance, and the resultant psychological stress works in their favor (2). Conversely, if athletes evaluate the situation and determines that they may not be able to handle the task, it may be viewed as a

threat. In such situations, athletes react in ways that are debilitative to high intensity muscular performance, both physically and cognitively.

Such perceptions of the competitive scenario can have physiological repercussions within the athlete's body. As a means of optimally demonstrating the muscular strength of an athlete, powerlifting is a sport best executed under a high physiological arousal state (23). According to Blascovich (2), a challenge state (where an athlete perceives the challenge as surmountable) will produce higher cardiac output and lower peripheral resistance. These physiological responses are facilitative to performance during gross motor activities requiring high arousal states, such as powerlifting. A threat state, where the athlete perceives the challenge as insurmountable, also increases cardiac output, but not to the same extent physiologically as a challenge state. In addition, a threat state physiologically increases peripheral resistance within the body, thus restricting blood flow and having a negative impact on physiological performance during high intensity gross motor activities (15, 25).

Competitive trait anxiety can be measured in athletes using a variety of instruments, including the Sports Competition Anxiety Test (SCAT) (13), the Sports Anxiety Test (21), and the Competitive State Anxiety Inventory II (13). The SCAT has especially wide acceptance and use in recent research (19, 20). Previous studies have documented the negative effects of competitive trait anxiety on athletic performance (2, 8, 15), but no research has yet been conducted on this topic during powerlifting competition. Furthermore, research needs to further explore general sex-based differences in anxiety and how they relate to athletes and specifically regarding strength power sports (18).

Powerlifting is a sport that requires high arousal states for mustering peak muscular performance and the highly tactical execution of the allotted lifts for the bench press, squat, and

deadlift. Both physiological and psychological responses of the powerlifting athlete could be undermined by high competitive trait anxiety. Therefore, the primary purpose of this investigation was to determine if a relationship existed between competitive trait anxiety measures and powerlifting performance.

METHODS

Experimental Approach to the Problem

The SCAT was administered at a regional collegiate powerlifting meet, which was held between three highly competitive university club teams (all national title holders in recent years), to determine if a relationship existed between competitive trait anxiety measures and powerlifting performance. The coaching staff for each club team was approached for permission before the competition, and all approved of the research being conducted as well as facilitated members of the research team broaching with the respective team members the topic of participation in this study. Both male and female participants volunteered to participate and were surveyed once they signed the informed consent form. The SCAT was chosen for its psychometric properties reported in the literature (test-retest reliability, validity) (13), and the survey measured the competitive trait anxiety of the participants prior to competition.

Subjects

This study involved 36 collegiate powerlifters (some who were or went on to be National Champions) affiliated with the aforementioned club teams from three large southern universities (Male = 26, Female =10; Age 19.9 +/- 1.5 yrs; Height 172.5+/- 8.6 cm; Weight 81.4+/- 21.0 kg). Participants were recruited from the population of competitors at the above-mentioned regional powerlifting meet, and they were distributed across the weight classes widely used for collegiate powerlifting (47.6kg: 1, 51.7kg: 1, 54.9kg: 1, 59.8kg: 3, 67.1kg: 2, 74.8kg: 7, 82.1kg: 4, 89.8kg:

9, 99.8kg: 5, Unlimited, or Super Heavy Weight (SHW): 3). Details on the athletes' performance levels are contained in Table 1.

<Insert Table 1>

Instrument

Sport Competition Anxiety Test (SCAT)

The SCAT is a 15-item instrument designed to measure the amount of anxiety an athlete experiences before competition (12). However, only 10 of the items measure symptoms associated with anxiety. The additional five items, which are not scored, reduce the likelihood of an internal response-set bias (18). Example items include "Competing against others is socially enjoyable"; "Before I compete I feel relaxed"; and "Before I compete I usually get uptight". The items are rated on a 3-point scale: "rarely", "sometimes", or "often." This instrument was previously validated in a variety of environments (12, 13) and has been recently used to compare anxiety in athletes of individual sports (such as swimming and weight lifting) to athletes from team sports (such as football and hockey)(24). Martens et al. (13) demonstrated evidence of high internal consistency on the SCAT (Kuder-Richardson Formula 20 (KR-20) values ranging from .95 to .97) and test-retest reliability (M retest reliability = .77).

Procedures

Participants were asked if they would like to participate in the research and, if willing, were given an informed consent document to read and sign in compliance with federal laws and required by the Institutional Review Board (IRB) at the University of Louisiana at Lafayette. All participants received a copy of the consent document. After informed consent was obtained, each participant completed data sheets containing questions about his or her powerlifting performance history as well as the 15 items on the SCAT (12). All participants completed both questionnaires

in the warm-up area before being called to perform his or her initial attempt of the meet at the competitive platform. In addition to actual lifting totals (squat, bench press, and deadlift), background data on all participants was collected, including sex, age, height, weight, personal best lifting totals and anticipated lifting totals**.** The final competitive results for each participant were collected for statistical analysis and practical application to strength training and competition.

Statistical Analysis

Normality of the data was examined by Shapiro-Wilk testing. Relationships between SCAT data, demographics, and lifting performances were analyzed using logistic regression, Pearson moment correlation, and Spearman rho. Sex differences on the SCAT were examined via one-way analysis of variance (ANOVA). The difference in SCAT total by weight classes was examined using a logistic regression. Effect sizes were determined using G*Power software (9), and all other analyses were performed with JMP 11.0 Pro (SAS Institute, Cary NC). Statistical significance was set *a priori* at alpha < 0.05.

RESULTS

Analysis of Normality

In all cases, except the percentage of personal best for the deadlift, the analysis via the Shapiro-Wilk test did not result in any significant variance, which suggests that the data was normally distributed ($W>0.95$, $p>0.50$). However, the Shapiro-Wilk test did indicate that the percentage of personal best for the deadlift was non-normally distributed ($W=0.920$, $p=0.013$), and thus non-parametric analysis was conducted for this variable.

SCAT by Weight Class

The difference in SCAT total by weight classes was examined using a logistic regression. The analysis resulted in a non-significant model (r=0.085, p=0.977). The effect of weight class in the model was non-significant (F=0.269, p=0.977).

SCAT and Sex Differences

The one-way ANOVA for sex and total SCAT score was significant (F = 3.82, p = 0.029, ES=1.31). The female athletes demonstrated higher SCAT scores than their male counterparts.

SCAT and Competition Performance

The SCAT total score was negatively correlated (r = -0.397, p = 0.02) to the athletes' percentage of best total achieved in the competition (Actual Performance Total/Best Comp Total *100) (See Figure 1). Of the individual lifts, the SCAT total score was negatively correlated to the percentage of personal best for the bench press (r = -0.368, p = 0.03) and the deadlift (Spearman's rho= -0.280, p = 0.05), but not significantly for the squat (r = -0.182, p = 0.27).

<Insert Figure 1>

SCAT and Goal Setting

Strategic goal setting was determined by statistically correlating the participants' anticipated combined lifting totals for the three best lifts (i.e. squat, bench press, and deadlift) and their anticipated best effort in each of the individual exercises. The SCAT total was not significantly related to the goal for overall performance of the athletes (r = -.281, p = 0.102), nor was it related to the goals for performance in the squat (r = -0.273, p = 0.112), bench press (r = -.294, p = 0.087), or deadlift (r = -0.239, p = 0.167).

When examining the athletes' goals expressed as a percentage of the personal best relative to the competition total, most athletes' goals, if achieved, would have been a personal best (mean: 102.4 ± 6.8%, n=7 reported goals less than 100%). When compared to SCAT total,

the goal total (expressed as a percentage of personal best) trended towards significant ($r = -0.307$, $p = 0.073$). Among the participants expressing goals that equaled greater percentages of personal best, the competitors reported lower scores on the SCAT, though the results were not statistically significant. Goal performance relative to personal best in the squat and bench press was not related to SCAT total score ($r < -0.232$, $p > 0.11$). However, for the deadlift, the goal performance to personal best percentage was significantly related to SCAT total ($r = -0.879$, $p = 0.012$). See Figure 2.

<Insert Figure 2>

DISCUSSION

The purpose of this investigation was to determine if competitive trait anxiety, as measured via a SCAT survey, influenced powerlifting performance. SCAT scores were determined by totaling the answers on the survey, and high scores were reflective of greater competitive trait anxiety, whereas lower scores indicated less anxiety. These results indicated a negative correlation between the SCAT score and athlete's percentage of personal best total in PL. Increased SCAT scores (reflective of more anxiety) were associated with decreased personal best PL totals in the bench press, deadlift, and squat (reflective of poorer performance). However, these results were non-significant when examining the squat lift. This finding would suggest that while the participants reported higher levels of anxiety, this state did not impact their personal best performance in the squat. Perhaps there is something inherently or psychologically different about the squat lift that led to these results, but there is little previous research on this subject to explain it. Therefore, further research is needed in order to confirm and expand on the present results. Similarly, the women in this study reported significantly higher SCAT measures when compared to the men. These findings suggest that the women in this study may have

viewed something differently about the powerlifting competition when compared to the men, but there is little previous research to help explain sex-based differences in perceived anxiety during strength competitions. However, sex-based differences that exist may also be due to disparities in the prevalence of anxiety-related disorders. In general, women display higher rates of anxiety than men (14). A study by Schael et al. (18) examined gender-based differences in psychological factors impacting French high level athletes. Results revealed that females were more likely to display psychopathology, including anxiety-related disorders. Further research is needed to provide more perspective on the present findings.

These results nonetheless are consistent with previous literature assessing the debilitative impact of high anxiety on performance during individual sports (7, 15). For example, Moore, Vine, Wilson, and Freeman (15) exposed participants during a golf-putting task to either a threat or a challenge anxiety-provoking situation. Participants in the challenge group had fewer errors and reported viewing the anxiety as facilitative. If powerlifters experience anxiety as a threat, it is likely to result in a subpar performance (2, 25). The high anxiety and associated low performance of the participants in this study indicated they may have been viewing the anxiety as a threat. Such athletes should be coached to employ strategies to cope with their anxiety in a more productive manner.

The results of this study indicate that the more anxiety powerlifting athletes perceived prior to competition, the poorer they performed during competition, suggesting that athletes experiencing greater anxiety tended to view the situation as threatening, impairing their cognitive functioning and making it more difficult for them to focus on lifting itself (6). According to Sun and Wu (22), competitive trait anxiety disrupts psychological function in elite athletes, lessening their performance measures. Linking this work to the present findings, competitive powerlifters

are dependent upon the domains of calm mental state and concentration [two of the four psychological factors for success discussed in the work of Sun and Wu (22)] for optimal performance on maximal lifts. Given the high physiological arousal state necessary for maximal lifts, a less calm mental state in the heat of competition may be more likely to elicit a perception that the scenario is a threat state, rather than a challenge state. Similarly, powerlifters who encounter lesser mental concentration during the heat of competition may be more likely to experience subpar performance outcomes.

Given the effects of anxiety on performance, athletes need to develop effective coping strategies to reduce stress and anxiety both before and during competitions. Therefore, it is important that athletes determine for themselves which type of coping mechanisms work best, given the plethora of available strategies and the differences in individual preferences. Cognitively, once athletes appraise each competitive scenario, they need to identify the most appropriate way to react in order to achieve the desired outcome. Generally, the various coping methods that athletes utilize fall into two categories: avoidance coping and approach coping (1). Avoidance coping is characterized by a lack of effort in order to adapt to the challenging situation, and approach coping involves intentionally confronting the scenario and overcoming the challenge (16). Individuals experiencing negative anxiety typically employ avoidance coping strategies during competitive scenarios perceived as stressful, preventing them from being confident in such situations. Practically speaking, athletes who gravitate to this cognitive strategy are apt to continue to feel anxious until they learn to better handle the situation. Given the correlation stated above of increased SCAT scores and decreased personal best performance, one can assume that the powerlifting athletes in this study who did not perform as planned were

experiencing negative anxiety and did not employ effective coping strategies. However, further study is needed to confirm this assumption.

Previous research shows a clear correlation between the amount of competitive trait anxiety experienced by an individual and the coping mechanism he or she uses most often in competitive situations. Athletes who have more negative competitive trait anxiety often choose coping strategies that are considered maladaptive, while individuals with low trait anxiety are drawn to adaptive coping mechanisms (6). Ljdokova and her colleagues (11) assessed the most effective coping strategies used among powerlifters, and they found that the top three strategies employed included 1) coach's assistance, 2) being alert during performance, and 3) the use of mental skill techniques (such as meditation, imagery, etc.). Powerlifters experiencing competitive trait anxiety should be encouraged to increase awareness of their anxiety to determine how to cope with it in a more productive manner during the heat of competition. Increased awareness and resultant coping strategies have the potential to reduce competitive trait anxiety and improve performance within this athletic population.

It is important that athletes learn to effectively deal with the self-identified anxiety encountered in competitive situations, increasing the odds that they have a positive performance. Although it is not clear what specifically caused anxiety among the athletes in the current study, previous research has indicated that cognitive functioning is affected by perceptions of stress and anxiety. The powerlifters in this study were performing in a competitive environment, which can result in higher anxiety levels. Training athletes to execute movements with the least amount of cognitive effort may be helpful in reducing anxiety and relaxing their minds, and this technique could specifically benefit powerlifters who must focus on the progression of their lifting plan rather than on the actual mechanics of lifting itself (9). Strength and conditioning professionals

may want to consider implementing sport psychology exercises into the overall training program, preparing powerlifters more thoroughly for competition. Similarly, strength and conditioning professionals may also consider referring athletes who demonstrate enduring anxiety in high stakes training and competitive scenarios to a sport psychologist for more involved assessment and intervention.

In conclusion, it should be noted that there are a few limitations that readers should take into consideration when interpreting these results. First, this sample size was small and self-selected, and the conclusions may not be generalizable to the whole of the population of powerlifters. Second, the SCAT is a psychological survey that requires participants to respond truthfully in order to obtain accurate results. There is the possibility that participants did not answer truthfully because they did not fully understand the question or were afraid to rate their anxiety accurately. There also could potentially be effects of reading SCAT before competing. Although this may have been true, this instrument was previously validated (12) and was deemed the best measure for the purposes for this study. With this in mind, future research should focus on the stress of individual competition by examining the effectiveness of prevalent coping strategies used to decrease stress and anxiety and increase performance. A greater understanding of the effects of anxiety in relation to preferred coping strategies would help coaches and athletes alike, enabling them to more effectively realize their full potential during competition.

PRACTICAL APPLICATIONS

Powerlifting requires strength athletes to effectively execute performance plans strategically in order to maximize performance. The tactical application of their performance plan requires an ability to perform under the pressure of competition. The results of this study indicate that competitive anxiety has the potential to negatively influence performance and

suggests that strength and conditioning professionals should consider adding anxiety-reducing cognitive exercises to their overall training programs. Implementing anxiety-reducing routines early in the training program becomes increasingly important as strength and conditioning professionals often use procedures similar to powerlifting competitions when testing individual athletes and teams for one-repetition maximums. The earlier an effective anxiety-reducing strategy is identified and employed in training, the more likely these strategies are to help athletes when they encounter anxiety-producing stressors during testing and ultimately competitions. Strength and conditioning coaches can apply such techniques through informal testing programs or competitions, where teams perform powerlifting progressions in the context of a team-based environment, in order to assess both effectiveness of the program and also the ability of the athletes to compete in front of peers and, ultimately, an audience of fans. Additionally, professionals who identify anxiety within an athlete in the early stage of training and address the issue proactively by teaching effective coping strategies are more likely to facilitate a higher level of performance by their athletes when participating in strength and conditioning testing or sporting events such as powerlifting meets.

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FIGURE LEGEND

Figure 1: Percentage of Personal Best total achieved by SCAT total

Figure 2: Deadlift goal to personal best (percentage) by SCAT total

Table 1: Competition Personal Bests Lifts (means ± *SD)*

Gender	Bench Press (kg)	Back Squat (kg)	Deadlift (kg)	Total (kg)
Male (n=26)	132.8±30.8	188.8±52.9	194.1±47.4	517.2±124.3
Female (n=10)	70.5±16.3	125.3±32.8	127.9±27.9	322.4±71.6