

Measurement of cognitive and somatic anxiety amongst first team high school rugby players

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Abstract

Currently, knowledge is limited about how high school rugby players experience cognitive and somatic anxiety when playing competitive rugby. The first aim of the study was to determine if high school rugby players displayed significant differences in cognitive and somatic anxiety before and after an important rugby match. The second aim sought to determine to what extent the important rugby match alters the cognitive and somatic anxiety experienced by high school rugby players. In order to realize these aims, high school rugby players were compared to male adolescents who were not participating in any type of sport. A purposeful sample of 10 first team high school rugby players and 10 male adolescents not participating in any type of sport was drawn from a high school situated in the Gauteng Province of South Africa. Cognitive anxiety was measured through the administration of the State and Trait Anxiety subscales of the State-Trait Personality Inventory Form Y (STPI-Y) and the Sport Competition Anxiety Test (SCAT). Somatic anxiety was measured by investigating the salivary cortisol levels of the rugby players. A baseline measure, along with measures on the day of an important rugby match and one week after the important rugby match were taken. Statistical analysis within the group of rugby players revealed that significant differences occurred in the state anxiety and SCAT scores. No significant differences occurred within the cortisol measures. When the rugby players were compared to adolescents not participating in any type of sport, significant differences were observed between the two groups on state anxiety and SCAT scores. No differences with regards to cortisol levels had occurred. It was concluded that the rugby players had experienced cognitive but not somatic anxiety.

Keywords: Cognitive anxiety, somatic anxiety, state anxiety, trait anxiety, cortisol.

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Introduction

It comes as no surprise that, in a country where rugby is regarded as one of the most popular sports, adolescent males are keen to participate in competitive school rugby (Jooste, 2011). Participating in team sports such as rugby is beneficial since participants learn new skills and are taught how to belong to a

team (Daniels, 2007; Jooste, 2011). When conducting a systematic review of 14 electronic data bases, Eime, Young, Harvey, Charity and Payne (2013) discovered that participation in sport improves physical health and prevents obesity. A qualitative study conducted on 27 adolescents aged 16-17 found that sport participation promotes social interaction amongst peers (Eime, Payne, Casey & Harvey, 2010). Wiersma (2000) furthermore believed that team sports will not only lead to enhanced motor skills, but provides participants with an environment where they develop cooperative skills, prosocial behaviours and learn how to commit time and energy. Participating in rugby will thus benefit the physical, psychological and social development of the adolescent (Eime et al., 2013, Wiersma, 2000). Daniels (2007) and Jooste (2011) both support the notion that the competitive dimension can expand these advantages. Jooste (2011) as well as Weinberg and Gould (2011) noted that participants in competitive sports are provided with a sense of purpose, learn how to deal with important life issues such as responsibility and become accustomed to working hard in order to reach certain goals. Neil, Mellalieu and Hanton (2006) conducted research on 115 male rugby union performers and concluded that exposure to competitive rugby encouraged participants to use imagery, enhanced their self-confidence and equipped them to deal with stressful events.

Despite the advantages associated with playing competitive rugby, Wiersma (2000) suggested that sport specialization during adolescence could expose the participant to unduly high amounts of stress. Sport specialization refers to the situation where the high school rugby player places his focus on a particular sport (rugby) and then train to compete competitively in this sport on a regular basis (Hill, 1987).

Stress within the competitive sporting context is often associated with the experience of anxiety (Coetzee, 2005; Hanton, Neil, Mellalieu & Fletcher, 2008; Jooste, 2011; Neil et al., 2006; Weinberg & Gould, 2011; Woodman & Hardy, 2003). Weinberg and Gould (2011:78) define anxiety as "... a negative emotional state characterized by nervousness, worry, and apprehension" Several sources of anxiety associated with competitive rugby have been identified. Examples of such sources are excessive involvement of parents, teachers and fans (Wiersma, 2000), hostile spectators (Jooste, 2011; Radochoński, Cynarski, Perenc & Siorek-Maślanka, 2011), the fear of making errors (Jooste, 2011), playing away from home (Bath, 2000; Jooste, 2011), playing in bad weather conditions (Bath, 2000; Jooste 2011) and the fear of injury (Jooste, 2011; Radochoński et al., 2011).

Weinberg and Gould (2011) have noted that, when anxiety is investigated, one should distinguish between state and trait anxiety. State anxiety is a temporary, emotional state characterised by subjective, consciously perceived feelings of apprehension, nervousness, tension and worry (Coetzee, 2005; Weinberg &

Gould, 2011) when a situation is perceived as stressful (Jooste, 2011). State anxiety will thus be experienced when the rugby player is playing against another team and is confronted by one or more of the sources of anxiety listed above.

Trait anxiety, on the other hand, is a behavioural disposition (Weinberg & Gould, 2011) and is characterised by a "... stable tendency ... to respond anxiously ..." to stressful situations (Du Plessis, 2014: 22) Individuals measuring high on trait anxiety will frequently display elevated levels of state anxiety when exposed to stressful situations (Coetzee, 2005; Weinberg & Gould, 2011). One can therefore say that individuals with high levels of trait anxiety will be predisposed to display high levels of state anxiety. This is the result of anxiety being a function of the individual's personality and not a reaction to a stressful situation (Weinberg & Gould, 2011). A rugby player with high levels of trait anxiety will thus measure high on state anxiety when exposed to any stressful situation associated with competitive rugby.

Kais and Raudsepp (2005) noted that state anxiety consists of two components, namely cognitive and somatic anxiety. Cognitive anxiety refers to the mental or thought component of anxiety and is related to worry, apprehension or negative expectations (Craft, Magyar, Becker & Feltz, 2003; Weinberg & Gould, 2011). Somatic anxiety refers to the degree of physiological activation of the autonomic nervous system (Coetzee, 2005; Craft et al., 2003; Jooste, 2011; Weinberg & Gould, 2011; Woodman & Hardy, 2003). Anxiety within the context of competitive rugby should therefore be perceived as a multidimensional concept (Hanton et al., 2008; Neil et al., 2006; Ooms et al., 2012).

Research findings related to the experience of cognitive and somatic anxiety within the same context are contradictory (Nejtek, 2002). Kristensen, Mortensen, and Mors (2009) discovered linkages between cognitive and somatic anxiety during their study of patients with panic disorder and social phobia. Their findings have been corroborated by Hodgson et al. (2009). These researchers tested 12 rock climbers in three climbing conditions designed to invoke low, moderate and high cognitive and somatic anxiety. Results revealed a relationship between cognitive and somatic anxiety (Hodgson et al., 2009). It was furthermore noted that changes in the safety rope had an impact on both cognitive and somatic anxiety (Hodgson et al., 2009). Hoehn-Saric and McLeod (2000), however, conducted an extensive literature review on General Anxiety Disorder (GAD) and found that GAD patients' experience of cognitive anxiety was not congruent with their physical state. They also discovered that the correlations between cognitive and somatic anxiety were low (Hoehn-Saric & McLeod, 2000). Hoehn-Saric and McLeod's (2000) findings were supported by the results of Jones and Hanton's study (2001). These researchers administered the Competitive State Anxiety Inventory-2 to a sample of 190 swimmers. The

swimmers were divided into three groups, namely, a cognitive group, a somatic group and a combined group. After the data had been analysed it was discovered that the somatic group reported less anxiety than the cognitive group (Jones & Hanton, 2001). No significant differences were found between the intensity of both cognitive and somatic anxiety for the cognitive and combined groups. The somatic group reported significantly lower intensities of anxiety than the other two groups (Jones & Hanton, 2001).

As a result of these contradictory findings, little is known of the manifestation of cognitive and somatic anxiety in stressful situations (Nejtek, 2002). Gaab, Rohleder, Nater and Ehlert (2005) further noted that research on the interaction between cognitive and somatic anxiety is sparse and advocated for the investigation of the issue. This implies that a dearth of information exist with regards to the experience of cognitive and somatic anxiety amongst high school rugby players playing competitive rugby. A review of the literature has confirmed that this is indeed the case.

The objectives of the study therefore were to determine if high school rugby players displayed significant differences in cognitive and state anxiety before and after an important rugby match, as well as investigate if exposure to competitive rugby alters the cognitive and somatic anxiety experienced by high school rugby players. In order to realize these objectives, the research compared high school rugby players to male adolescents who were not participating in any type of sport.

Methodology

A purposeful sample was drawn from a high school located in the Gauteng Province of South Africa. The high school was selected because 1) it is nationally and internationally renowned for its excellent rugby performance and 2) it was located close to the researchers. The school provided dual medium education and participants were thus proficient in either English or Afrikaans. The sample consisted of 10 male adolescents not participating in any type of sport (Group 1) and 10 rugby players (Group 2). All participants were white males and all the rugby players were members of the school's first rugby team. Participants were aged from 17 to 19 years ($M = 18.0$, $SD = 1.00$). Each participant signed a consent form to confirm their voluntary participation in the study and to indicate that the results may be used for research purposes. Written consent was obtained from the participants' parents/legal guardians, the school principal and other relevant authorities before the participants were approached.

Measurements used in the study

Cognitive anxiety

State-Trait Personality Inventory Form Y (STPI-Y). State and trait anxiety was measured through the state and trait anxiety subscales of the STPI-Y. The state anxiety subscale consists of 10 items measuring how participants feel at a particular moment (Spielberger et al., 1979). Responses are indicated on a four-point scale (1 = not at all, 2 = somewhat, 3 = moderately so, 4 = very much). The trait anxiety subscale also consists of 10 items and participants need to indicate on a four-point scale how they felt in general (1 = almost never, 2 = sometimes, 3 = often, 4 = almost always) (Spielberger et al., 1979). A South African study investigating the psychometric properties of the STPI-Y reported Cronbach's alphas ranging from 0.80 (trait anxiety) to 0.84 (state anxiety) (Du Plessis, 2014).

Sport Competition Anxiety Test (SCAT). The SCAT consists of 15 items and measure how participants typically feel during competitive situations (Potgieter, 2009). It is a sport-specific measure of anxiety that was developed by Martens (1977). Participants indicate on a three-point scale (1 = hardly ever, 2 = sometimes, 3 = often) the extent to which they agree with given statements. A mean test-retest score of 0.77 with a range of 0.57 to 0.93 was reported for the instrument (Potgieter, 2009).

Somatic anxiety

Salivary cortisol. Exposure to a stressful situation (an important match) will lead to increased activity in the hypothalamus-pituitary-adrenal (HPA) axis (Holleman, Vreeburg, Dekker & Penninx, 2012). This will result in an increase in cortisol secretion (Coetzee, 2011; Holleman et al., 2012). This is a typical example of physiological activation associated with the autonomic nervous system. As a result, a decision was made to study somatic anxiety by investigating cortisol levels. The least intrusive way of obtaining cortisol samples is by obtaining salivary specimen (Coetzee, 2011; Gaab et al., 2003; Takai et al., 2004; Takahashi et al., 2004). This is deemed a valid and reliable measure of cortisol in the sporting context (Haneishi et al., 2007; Hodgson et al., 2009; Quested et al., 2011). Salivary samples were obtained by requesting the participants to spit into sterile tubes. Participants were requested not to eat or drink anything before presenting their samples. After all the necessary samples were obtained, it was analysed using the DSL-10-671000 ACTIVE© Cortisol Enzyme Immunoassay kit obtained from AEC-Amersham (PTY) LTD. The biochemical analysis was conducted by a qualified biochemist according to the manufacturer's specifications.

Data collection

Data collection occurred in a quiet room provided by the school and consisted of three time-points. Time-point one involved a baseline measurement that was taken a week before the first team played in an important match. Time-point two took place on the morning of the important match. Time-point three was obtained one week after the important match. Participants provided salivary specimen and completed both the STPI-Y and SCAT at all three time-points.

Analysis

SPSS Version 20.0 was employed for data analysis. The Friedman Test was used to determine if any significant differences occurred in cognitive and somatic anxiety before and after the important match. The results are displayed in Table 1.

Table 1: Friedman tests with regards to cognitive and somatic anxiety

Measure	Time-points	N	Test Statistic	Asymptotic Sig. (2-sided test)	Effect size (r)
State anxiety (STPI-Y)	1-3	10	11.41	0.003	2.08
Trait anxiety (STPI-Y)	1-3		3.10	0.213	0.57
SCAT	1-3	10	14.58	0.001	2.66
Cortisol	1-3	10	2.60	0.27	0.47

Table 1 indicates that no significant differences occurred in the rugby players' trait anxiety across the three time points. Trait anxiety thus appeared to remain stable across the three time points. No significant changes took place in their cortisol levels across the three time points and it is concluded that no significant differences occurred across the three time points with regards to somatic anxiety. Significant differences, however, occurred in both the state anxiety and SCAT scores. Post-hoc analyses in the form of Wilcoxon Signed Rank Tests were performed to investigate these differences.

The post hoc analyses conducted on the state anxiety scores revealed that a significant difference occurred between time-point 2 (the morning of the important match) and time-point 3 (a week after the important match) ($z = -1.45$, $p < 0.001$). The median score for state anxiety reduced from time-point 2 (Md = 2.05) to time-point 3 (Md = 1.25).

Wilcoxon Signed Rank tests furthermore showed that, with regards to the SCAT, significant differences occurred between time-points 1 (baseline) and 2 (the morning of the important match) ($z = -3.47$, $p < 0.001$) and time-points 2 (the morning of the important match) and 3 (a week after the important match) ($z = 2.91$, $p < 0.05$). The median score for the SCAT increased between time-point 1

(Md = 1.40) to time-point 2 (Md = 2.95) where after it decreased from time-point 2 (Md = 2.95) to time-point 3 (Md = 1.65).

In order to determine if significant differences had occurred between those not participating in any type of sport and the rugby players, Mann-Whitney U tests were performed for the three time-points. The results are indicated in Table 2.

Table 2: Mann-Whitney U tests with regards to cognitive and somatic anxiety

Measure	Time-point	Mann-Whitney U	Standardized Test Statistic	Asymptotic Sig. (2-sided test)	Effect size (r)
State Anxiety (STPI)	1	48.00	-0.15	0.88	0.03
	2	8.00	-3.21	0.00	0.72
	3	45.50	-0.34	0.73	0.08
Trait Anxiety (STPI)	1	67.50	1.33	0.19	0.30
	2	56.00	0.46	0.65	0.10
	3	72.50	1.72	0.09	0.38
SCAT	1	62.50	0.95	0.95	0.21
	2	4.00	-3.51	0.00	0.79
	3	35.00	-1.15	0.25	0.26
Cortisol	1	32.00	-1.36	0.17	0.30
	2	48.00	-0.15	0.88	0.03
	3	43.00	-0.53	0.60	0.12

No significant differences in trait anxiety were observed across the three time-points. It was concluded that the two groups did not differ with regards to the experience of trait anxiety and the latter thus did not play a role in the significant differences that occurred on the state anxiety and SCAT scores for time-point 2 (morning of the important match). Table 2 further shows that the two groups did not differ significantly with regards to cortisol levels and it is therefore concluded that somatic anxiety remained stable across the three time-points for the two groups.

Discussion

The results indicate that the first team high school rugby players experienced cognitive but not somatic anxiety. The experience of cognitive anxiety might be explained by rugby players' participation in an important rugby match.

These findings corroborate Hoehn-Saric and McLeod's (2000) results. Their extensive literature review on General Anxiety Disorder (GAD) discovered that GAD patients' with high amounts of cognitive anxiety did not display any form of somatic anxiety. When investigating the effect of an emotionally stressful situation on cortisol release, Netjek (2002) also found no association between the amount of emotional stress experienced and the amount of cortisol released. Similarly, Haneishi et al. (2007) noted in their study of soccer players that no significant correlations were observed between cognitive anxiety and the release of salivary cortisol.

The present results suggest that, although state anxiety consists of a cognitive and somatic component, individuals such as rugby players are able to experience the one but not the other. This further seems possible when one studies the psychophysiology of cognitive and somatic anxiety.

As was previously stated, cognitive anxiety is the mental process the rugby player demonstrates before an important match as a result of being exposed to one, or a combination of, the sources of anxiety discussed earlier in this paper. These processes normally consist of feelings related to worry, apprehension or negative expectations (Craft et al., 2003; Weinberg & Gould, 2011).

When cognitive anxiety is experienced, the central nucleus of the amygdala sends information directly to the hypothalamus and the brain stem areas (Davis, 1992, Jooste, 2011). The hypothalamus is connected through processive stress pathways to the pituitary and adrenal glands (Coetzee, 2005; Gaab et al., 2005). These pathways consist of inhibitory and excitatory limbic-sensitive structures. The purpose of these pathways is to determine how threatening a stressor is so that an appropriate hormonal response, such as the release of cortisol, is elicited via the pituitary and adrenal glands in order to enable the individual to physically deal with the stressor (Coetzee, 2005; Gaab et al., 2005). The pathways can be described as a place where some form of cognitive appraisal occurs (Gaab et al., 2005). When the pathways are not excited during a confrontation with a stressor, the HPA axis will not be activated and no cortisol will be released (Coetzee, 2005; Gaab et al., 2005).

It is thus theorised that, during the processing of the information that caused the cognitive anxiety displayed by the rugby players participating in the study, the processive stress pathways connecting the hypothalamus with the adrenal and pituitary glands were not excited and the HPA axis were not activated (Gaab et al., 2005). Somatic anxiety has therefore not occurred.

The above discussion suggests that the intensity with which the cognitive anxiety is experienced will determine whether somatic anxiety will take place or not (Jones & Hanton, 2001). Although the rugby players thus experienced an increase in their levels of cognitive anxiety, this increase was not intense enough to bring about somatic anxiety. This confirms Hardy's (1996a, 1996b) notion that athletes' mental states should be perceived as the dominant determinant of how anxiety would be experienced in stressful situations.

Since it appears that the rugby players had not experienced somatic anxiety, it is assumed that they are not at risk of somatic dysfunction or other negative physical effects of anxiety (Potgieter, 2006). It should be noted, however, that cognitive anxiety could still be harmful to the rugby players in that they could experience excessive forms of fear (Anshel, 2012, Neil et al., 2006). The most notable of these will be the fear of failure (Potgieter, 2006). Such fear will have a negative impact on, for example, performance, self-confidence and self-esteem (Potgieter, 2006, Weinberg & Gould, 2011). Hanton, Wade and Connaughton

(2005: 133) furthermore warned that the continuous experience of cognitive anxiety could become “habituated and ingrained” within the mind of the rugby player. This means that he becomes accustomed to react to important matches with elevated levels of cognitive anxiety. This will lead to a situation where the rugby player will always display elevated levels of cognitive anxiety before important rugby matches. The levels of cognitive anxiety is now, however, not the result of exposure to the important match, but the by-product of associating cognitive anxiety with any important rugby match. Responding to important matches with elevated levels of cognitive anxiety has now become a learned response (Anshel, 2012; Schachter, 1966). In order to circumvent any of the possible negative effects of cognitive anxiety, it is suggested that some form of intervention is necessary to assist the rugby players with their perception and interpretation of such anxiety.

Limitations and Recommendations

Since the amount of control the players perceived they had before and during the rugby match were not measured, one cannot determine if the anxiety experienced was facilitative or debilitating (Burton & Naylor, 1997; Hanton & Connaughton, 2002; Jones & Hanton, 2001). It is therefore suggested that future research should focus on determining if the anxiety displayed was facilitative or debilitating in nature. Because of the small sample size used in the present study, it is also suggested that the present findings must be interpreted with some caution and future research should focus on expanding the sample.

Haneishi et al. (2007) found significant differences when pre- and postgame cognitive and somatic anxiety had been compared to pre- and post-practice scores. It is thus recommended that these forms of anxiety should be measured during practice sessions as well. Future researchers should also focus on the entire rugby season instead of taking a cross-sectional approach as was the case with the current study.

Conclusion

The first team high school rugby players’ cognitive appraisal of the important rugby match did not lead to sufficient stimulation of the hypothalamus and thus the HPA axis was not activated. Cortisol levels were therefore not affected. As a result, cognitive anxiety was experienced in the absence of somatic anxiety. Although somatic anxiety had not been experienced, the sole experience of cognitive anxiety might be harmful since it could lead to excessive forms of fear associated with important rugby matches that would impact negatively on performance, self-esteem and self-confidence.

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