PSYCHOLOGY

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Comparison of competitive anxiety and self-confidence in Brazilian Jiu-Jitsu skills levels: a cross-sectional in-event study

Abstract

Background. Competitive anxiety and self-confidence can be influenced by a number of factors, including skills levels and changes during sporting events. However, the effect of changes in-event are unclear.

Problem and Aim. We aimed to compare in-event competitive anxiety and self-confidence among Brazilian Jiu-Jitsu (BJJ) athletes with different belt colors and compare the levels between the first and second bouts. 113 BJJ male athletes (26.6 ± 5.36 years) competing in the Northeastern Open Brazilian Jiu-Jitsu Championship 2017 were included.

Methods. They responded to the Competitive State Anxiety Inventory (CSAI-2R) after weighing and 15 min before their first fight and those who won responded again before their second bout. Cognitive anxiety, somatic anxiety and self-confidence domains were analyzed. Null-hypothesis test and magnitude-based inference analysis were performed.

Results. The athletes in the black belt group were older and more experienced (p<0.05). There was no difference between belt color groups in cognitive and somatic anxiety, and self-confidence (p>0.05). However, after winning there was a decrease in cognitive and somatic anxiety only in the blue, purple and brown belt groups, while only the black belt group increased self-confidence.

Conclusions. We conclude that skills levels did not influence competitive anxiety and self-confidence in combat sports, but it did influence how it changed during a competition.

Introduction

Combat sports have become popular in the recent years. Interestingly, Brazilian Jiu-Jitsu (BJJ) has gained attention, especially due to its successful use in the Mixed Martial Arts (MMA) [Andreato et al. 2013]. BJJ is intermittent in nature [Andreato et al. 2017] with intense effort duration, ranging from six to eleven times greater than the light effort [Del Vecchio et al. 2007; Del Vecchio et al. 2015]. Briefly, the goal of BJJ is to subjugate the opponent through levers (ankle, knee, shoulder, elbow, and wrist), bottlenecks (restriction of blood flow and breathing in the neck) or score [Andreato et al. 2012; Baez et al. 2014; Del Vecchio et al. 2007; Del Vecchio et al. 2016]. Thus, BJJ requires muscle strength, especially isometric strength, flexibility, and also cardiorespiratory fitness [Andreato et al. 2013].

In several combat sports, the athletes undergo numerous combats in the same day with short intervals, which result in increased physiological, physical, and psychological stress that could affect competitive performance [Capranica et al. 2017]. Previous studies have found that increased cortisol circulation before an official BJJ combat [Moreira, et al. 2012] as well as increased cortisol and salivary immunoglobulin (i.e. stress-related biomarkers) and reduced physical performance after the fights [Andreato et al. 2013], but this studies just speculated the relationship between biomarkers and performance. Additionally, high levels of cortisol negatively affect the autonomous nervous system and cognitive anxiety [Filaire et al. 2001; Papacosta et al. 2016]. Therefore, considering that competitive performance is determined by the motor, cognitive, and

psychological function [Cheron *et al.* 2016], both physical fitness and psychological control are crucial to athletes to maintain balance and improve performance.

Accordingly, the Multidimensional theory of competitive state anxiety (MTCSA) clarifies psychological changes such as anxiety, nervousness, worry, and apprehension associated with pre-competition psychomotor agitation [Martens *et al.* 1990]. The MTCSA proposes that (i) the cognitive component of anxiety is influenced by the sport performance, (ii) somatic anxiety results from the bodily sensations linked to physiological and autonomic alterations, and (iii) self-confidence is linked to positive/negative thinking related to performance [Sonoo *et al.* 2010]. Thus, self-confidence is negatively related to cognitive and somatic anxiety, and is associated with the ability to control negative emotions more effectively, hence, is suggested that high self-confidence is one of the most important variables associated with competitive performance [Fernandes *et al.* 2014; Fernandes *et al.* 2013; Millet *et al.* 2005]. Moreover, other studies also show a negative relationship between cognitive and somatic anxiety with sports performance [Dias *et al.* 2009; Fernandes et al. 2013; Fortes et al. 2016].

In addition, studies have shown that several factors may influence competitive anxiety, such as: sex, sports (i.e. individual or team sports), predominant movement (i.e. gross vs. fine motor skills), and the level of the athletes [Cox *et al.* 2003; Fernandes *et al.* 2012; Luiselli, Reed 2011; Mellalieu *et al.* 2004]. For instance, athletes from individual sports (i.e. athletics and swimming) present higher levels of competitive anxiety compared with team sport modalities (i.e. soccer, volleyball) [Craft *et al.* 2003; Martens *et al.* 1990], whereas international level athletes present lower competitive anxiety compared to national level athletes [Morales *et al.* 2012]. Therefore, time of experience may be an important mediator of competitive anxiety, that is, years of practice may reduce the likelihood of failure due to negative emotional states [Mellalieu *et al.* 2004].

In combat sports, competitive anxiety has been studied as a predictor of the fight outcome [Papacosta *et al.* 2016; Radochonski *et al.* 2011] as well as its relationship with stress biomarkers [Capranica *et al.* 2017; Moreira *et al.* 2012], alterations in the autonomous nervous system [Morales *et al.*, 2012] or brain electrical activity [Kolayis 2012]. In a classical study, Terry and Slade [1995] found that karate athletes that won their first contest showed lower cognitive and somatic anxiety and higher self-confidence than the athletes that lost their fights. Similar results were demonstrated by Chapman *et al.* [1997] with tae kwon-do athletes. The authors also showed that according to the level of competitive anxiety and self-confidence, about 62% to 79% athletes could be forecasted as winners or non-winners [Chapman *et al.* 1997; Terry, Slade 1995].

It is important to consider that those studies have been limited to experienced athletes (i.e. brown/black belt athletes) or included a full range of graduations, a single measure before competition or simulated fights performed with a timing of measurement. These experimental designs do not necessarily represent competitive anxiety in the moments that precede the fights (i.e. 60 min before fighting), especially when the fight has the official weigh-in close to the beginning of the fight. Furthermore, considering that BJJ competitions are usually in the form of simple elimination and athlete undergo several fights in a single day with short intervals of rest between them (i.e. at least 10 minutes). Thus, it is important to understand how competitive anxiety shifts during the competition, especially considering the high psychophysiological load generated by this competition format [Capranica *et al.* 2017].

A recent systematic review has described the physical and physiological characteristics of BJJ athletes and has suggested that studies analyzing whether differences exists between sex, color belt, competitive levels, and weight categories [Andreato *et al.* 2017]. Despite that study targeted physical and physiological characteristics, the same rationale applies to psychological characteristics during both training and competition. Therefore, the purpose of this study was to compare anxiety and self-confidence between the belt colors (graduations) at the pre-fighting moment and to compare anxiety and self-confidence before the first and the second fight in the competition. Considering that the time of experience is negatively correlated with anxiety and positively correlated with self-confidence [Craft *et al.* 2003], we hypothesized that athletes with higher skills (i.e. brown and black belts) would present lower anxiety and higher self-confidence compared to their peers with lower graduation (i.e. blue and purple belt holders). Additionally, in accordance with the MTCSA predictions [Martens *et al.* 1990], we also hypothesize that after winning a fight anxiety levels would decrease and self-confidence would increase before the subsequent fight.

Material and Methods

Study design

This is a cross-sectional study, with data collected during a regional BJJ championship. Previously to the competition, researchers received permission from the competition organizers to contact the athletes in the warm-up area. For the data acquisition, the researchers introduced themselves to the athletes and informed about the study procedures. The athletes were not told that the purpose of the study was to compare competitive anxiety between the belt colors in order to avoid any influence on their responses. Then, athletes were invited to participate in the research vol-

untarily. All athletes who agreed to participate in the study were asked to sign the Informed Consent Form. Finally, the participants filled in a form containing personal information and the Competitive State Anxiety Inventory (CSAI-2R). This procedure was performed in the post-weighting period, approximately 20 minutes before the athlete's first fight. In addition, the athletes who won the first contest were invited to respond to the questionnaire again 15 minutes after the fight. At this moment, the researchers assisted in the responses since athletes have excessive fatigue in the forearm region. We measured only the first two contests because as the competition goes on (samples' elimination) the sample size decreased substantially. The present study was approved by the Institutional Ethics Committee (protocol number: 1.762.512) and was performed according to the Declaration of Helsinki.

Participants

The sample of this study was composed by 113 male athletes (26.6 ± 5.36 years old) recruited in a non-probabilistic way. The athletes were participating in the Northeastern Open Brazilian Jiu-Jitsu Championship 2017 in the Adult (18 to 29 years old, 57.2%) and Master I (30 to 35 years old, 42.8%) age categories, divided into featherweight (up to 70 kg, 28.3%), lightweight (up to 76 kg, 38%), and middleweight (up to 82.3 kg, 33.7%) divisions. The graduation of the athletes were blue (28.3%), purple (28.3%), brown (22.1%), and black (21.3%) belts.

Measures

Competitive anxiety was assessed using the Competitive State Anxiety Inventory (CSAI-2R), which consists of 17 items divided into three domains: competitive anxiety (questions number 2, 5, 8, 11, and 14), somatic anxiety (questions number 1, 4, 6, 9, 12, 15, and 17) and self-confidence (questions number 3, 7, 10, 13, and 16) [Cox *et al.* 2003]. The CSAI-2R is answered on a four-point Likert scale ranging from 1 (nothing) to 4 (quite). Considering that some participants would respond to questionnaire twice in a relatively short interval, we replaced the numbers by a color scale, ranging from white (corresponding to 1) to gray (corresponding to 4). Additionally, in the second evaluation, 15 minutes after the victory in the fight, the application of the questionnaire was conducted in the form of an interview. This procedure has been showed to avoid learning effects. The CSAI-2R was translated and validated to Brazilian Portuguese and showed good internal consistency for cognitive anxiety (0.84), somatic anxiety (0.78), and self-confidence (0.80) [Fernandes *et al.* 2012]. In the present study, the internal consistency of the CSAI-2R was assessed using Cronbach's alpha and showed good internal consistency for the general scale (0.80) as well as for cognitive anxiety (0.80), somatic anxiety (0.81), and self-confidence (0.85) domains. In addition to the

CSAI-2R, participants also reported body mass, height, and time of experience in BJJ.

Statistical Analyses

For the analysis, the athletes were grouped according to the skills level (i.e. belt color: blue, purple, brown, and black). The distribution of the data was assessed using the asymmetry and kurtosis method and a normal distribution was assumed if their respective values were less than twice their standard errors. Data are reported as mean and standard deviation. Levene's test was used to assess homogeneity of variances. The analysis of variance (ANOVA) was used to compare age, body mass, height, and time of experience among the skills level group. A multivariate analysis of covariance (MANOVA) was used to compare the CSAI-2R dimension scores according to skill level. The age and time of experience of the participants were adopted as a covariate. Furthermore, a repeated-measures ANOVA was used to compare CSAI-2R dimensions between the first and second contests. The Bonferroni post hoc was adopted when a significant difference was found. Thresholds for Cohen effect size were: > 0.2 (small), > 0.5 (moderate), and > 0.8 (large). In addition to the hypothesis tests, a magnitude-based inference analysis was used in order to identify if the changes in the CSAI-2R scores were greater than the smallest worthwhile change, which was defined as the product of 0.2 by the pooled standard deviation. The following thresholds were adopted: 1%, almost certainly not; 1-5%, very unlikely; 5-25%, probably not; 25-75%, probably; 75-95%, likely; 95-99%, very likely; > 99%, almost certainly [Hopkins *et al.* 2009]. If the chance of having a beneficial or harmful effect on performance was both > 5% the true difference was considered "uncertain". We performed auxiliary analysis to test the association between the CSAI-2R domains using the Pearson correlation coefficient, for the entire sample and for the athletes who won their first fight. A significance level of $p \leq 0.05$ was adopted for all comparisons. The SPSS 20.0 was used for the analysis.

Results

Table 1 shows the general characteristics of the athletes according to the belt color. There was a significant difference in age (p <0.001) and years of experience (p <0.001), in which the black belt holders were older and more experienced than the other groups.

Table 2 shows the results of competitive anxiety, according to CSAI-2R domains. There was no difference in anxiety and self-confidence between belt colors. The covariance analysis showed no effect of age and time of experience (p > 0.05).

A repeated measures ANOVA indicated a significant effect of time on cognitive anxiety ($F_{(1.42)}$= 2.951; p = 0.04), which decreased after the first fight in the pur-

Table 1. General characteristics of Brazilian Jiu-Jitsu athletes according to the belt color.

Variables	SKILL LEVEL				F	p
	BLUE (n = 32)	PURPLE (n = 32)	BROWN (n = 25)	BLACK (n = 24)		
Age (years)	23.7 ± 4.68	25.9 ± 5.35	28.0 ± 4.92[a]	30.0 ± 4.47[a,b]	7.85	0.001
Body mass (kg)	74.1 ± 4.49	75.1 ± 5.42	76.1 ± 5.43	74.9 ± 5.36	0.80	0.50
Height (m)	1.73 ± 0.05	1.73 ± 0.05	1.72 ± 0.05	1.75 ± 0.05	0.96	0.41
Experience (years)	4.1 ± 2.42	7.3 ± 2.43[a]	9.9 ± 2.42[a]	14.6 ± 2.43[a,b,c]	33.22	0.001

a: $p < 0.05$ compared to blue belts; b: $p < 0.05$ compared to purple belts; c: $p < 0.05$ compared to brown belts

Table 2. Competitive anxiety in Brazilian Jiu-Jitsu fighters according to the belt color.

CSAI-2R	SKILL LEVEL				F	p	ES
	BLUE (n = 32)	PURPLE (n = 32)	BROWN (n = 25)	BLACK (n = 24)			
Cognitive anxiety	1.88 ± 0.79	1.83 ± 0.75	1.88 ± 0.68	1.70 ± 0.71	0.32	0.81	0.01
Somatic anxiety	1.94 ± 0.62	1.81 ± 0.71	1.82 ± 0.64	1.66 ± 0.58	0.86	0.46	0.02
Self-confidence	2.85 ± 0.81	2.77 ± 0.91	2.75 ± 0.91	2.67 ± 1.05	0.18	0.91	0.01

ES = Effect Size

Table 3. Competitive anxiety in Brazilian Jiu-Jitsu fighters according to the belt color.

Skill Level		1ª combat	2ª combat	ES (90%CI)	Qualitative change (combat 2 vs 1)	
					% chance to be Harmful / trivial / beneficial	Inference
Blue (n=13)	CA	1.60 ± 0.93	1.63 ± 0.78	0.04 (-0.22 to 0.29)	14 / 80 / 6	Uncertain
	SA	1.89 ± 0.78	1.67 ± 0.58	-0.31 (-0.72 to 0.10)	2 / 30 / 68	Possibly
	SC	2.90 ± 0.95	2.85 ± 1.14	-0.06 (-0.45 to 0.33	27 / 60 / 13	Uncertain
Purple (n=15)	CA	1.77 ± 0.64	1.41 ± 0.42*	-0.63 (-1.13 to -0.14)	1 / 7 / 93	Probably
	SA	1.67 ± 0.59	1.39 ± 0.30	-0.57 (-1.23 to 0.09)	3 / 14 / 87	Probably
	SC	3.26 ± 0.77	3.40 ± 0.98	-0.15 (-0.12 to 0.43)	2 / 59 / 38	Trivial
Brown (n=10)	CA	1.92 ± 0.68	1.44 ± 0.71*	-0.66 (-1.21 to -0.11)	1 / 7 / 92	Probably
	SA	2.00 ± 0.77	1.85 ± 0.61	-0.20 (-0.58 to 0.17)	4 / 45 / 51	Possibly
	SC	2.84 ± 0.93	2.70 ± 1.05	-0.14 (-0.67 to 0.38)	42 / 45 / 13	Uncertain
Black (n=8)	CA	1.77 ± 0.70	1.92 ± 0.63	-0.25 (-0.26 to 0.76)	57 / 36 / 7	Uncertain
	SA	1.68 ± 0.50	1.69 ± 0.64	0.02 (-0.45 to 0.49)	25 / 55 / 20	Uncertain
	SC	2.96 ± 1.07	3.00 ± 1.06	0.33 (-0.15 to 0.82)	4 / 27 / 69	Possibly

Note: CA = cognitive anxiety; SA = somatic anxiety; SC = self-confidence; ES = effect size; 90%CI = 90%confidence interval; * significant different from the first fight (p<0.05).

ple and brown groups. In addition, a magnitude-based inference analysis showed that the effect of the first fight on the cognitive anxiety previously to the subsequent contest presented a probably beneficial impact in the purple and brown belts groups (Table 3).

The correlation results for the entire sample (n = 113) showed a positive correlation between somatic and cognitive anxiety (r = 0.57; p < 0.01), but neither cognitive (r = 0.005; p = 0.95) nor somatic anxiety (r = -0.10; p = 0.29) were correlated to self-confidence. Similar results were a found for the athletes who won the first fight (n = 46), whose somatic and cognitive anxiety were positively correlated (r = 0.43; p < 0.01), whereas self-confidence was not associated to either cognitive (r = 0.06; p = 0.68) or somatic anxiety (r = -0.08; p = 0.58).

Discussion

The aim of the present study was to compare competitive anxiety and self-confidence between varying skills levels in BJJ athletes (i.e. color belt) during the pre-fight period as well as to analyze the changes from the first to the second bout. Our findings demonstrated similar scores of competitive anxiety and self-confidence between groups. On the other hand, while cognitive and somatic anxiety decreased after the first bout in the blue, purple, and brown belt groups, self-confidence increased in the black belt group. To the best of our knowledge, this is the first study to compare competitive anxiety during in-event combat sports and to monitor its changes during competition.

Considering that more skilled athletes present higher graduations (i.e. brown and black belts) and that the time of experience may influence competitive anxiety [Mellalieu *et al.* 2004], we expected that these athletes would present lower competitive anxiety and higher self-confidence levels than their less graduated peers. However, this supposition was not confirmed in our study. It is possible that the athletes presented similar levels of anxiety due to the high arousal needed prior to the first fight. Furthermore, athletes with different skills levels might experience similar competitive anxiety but interpret the symptoms in a different way. This suggests that how individuals interpret anxiety symptoms (facilitative or debilitative) should be considered in future investigations, in addition to the intensity of competitive anxiety symptoms. In addition, considering that age and time of experience were different between some groups we also expected these variables could mediate the influence of the skill level on anxiety and self-confidence, but this was not confirmed as well. Contrasting with the results of the present study, Mellalieu *et al.* [2004] demonstrated that more experienced rugby and golf players (> 10 years of practice) presented lower intensity and direction of trait competitive anxiety compared to less experienced athletes (< 10 years of practice). It is important to consider that competitive anxiety depends on the type of sport such as individual or team sports [Martens *et al.* 1990]. In fact, Fernandes *et al.* [2013] found that team sports athletes and women presented higher cognitive anxiety while men with higher experience presented increased self-confidence. Likely, the main reason for the different results is that we assessed competitive anxiety immediately before the competition (i.e. after weight-in) while the quoted study assessed trait competitive anxiety, which may differ substantially. In addition, in some combat sports (i.e. BJJ, judo, karate) athletes participates in three combats whiting the same day, which poses great physical demand as well as require high ability to cope with their emotional states. Interestingly, a recent systematic review and meta-analysis conducted by Buhlmayer *et al.* [2017] found that both physiological and psychological performance surrogates improved to a meaningful extent following mindfulness practice. This meta-analytical review included nine trials with 290 healthy sportive participants from various sports modalities such as athletics, cyclists, dart throwers, hammer throwers, hockey players, hurdlers, judo fighters, rugby players, middle-distance runners, long-distance runners, shooters, sprinters, volleyball players. Interventions lasted from 4 weeks to >2 years, with twice a day to once a week frequency and average duration between 50-60 minutes. The authors concluded that based on available evidence, mindfulness practice can be considered as a performance-enhancing complementary training approach, especially in precision sport disciplines such as shooting and dart throwing [Buhl-

mayer *et al.* 2017]. It should be noted, however that a large heterogeneity was found for some outcomes and, thus, high-quality studies are certainly warranted. Nonetheless, this suggests that mindfulness techniques may help to improving psychological performance surrogates.

The hypothesis that after winning the athletes would present decreased competitive anxiety and improved self-confidence when facing a subsequent combat in the competition, was only partially confirmed. Although cognitive anxiety decreased after winning the first combat, neither somatic anxiety nor self-confidence was changed. Nonetheless, this change was observed only for the intermediary graduated athletes (i.e. purple and brown belt). It is important to note that this result might be influenced by decrease in sample size due to BJJ championship structure, so that non-winners are eliminated from the competition. This is an inevitable outcome when investigating sport competitions that are based on a selection process. Considering the limitation of p-value-based statistical tests to detect changes in sports sciences, Hopkins *et al.* [2009] proposed a magnitude-based inference analysis as an alternative approach. This three-level scale of magnitude analysis (i.e. beneficial, trivial, and harmful) considers the effect size as well as confidence intervals in relation to the smallest worthwhile change, which would be represented as the smallest change to be considered relevant in a practical context [Batterham, Hopkins 2005]. In fact, the magnitude-based inference analysis showed that winning the first fight had a likely practical beneficial effect on decreasing somatic anxiety on the purple and brown belt as well as increasing self-confidence in the black belt athletes.

It is important to note that the pattern of changes after winning the first fight varies according to the group (see Table 2). While the blue, purple, and brown belt groups tended to decrease either cognitive or somatic anxiety with no change in self-confidence, the black belt group presented an inverted pattern. Two classical studies [Terry, Slade 1995; Chapman *et al.* 1997], demonstrated that karate and tae kwon-do athletes that won their first contest showed lower cognitive and somatic anxiety and higher self-confidence than the non-winning athletes. Interestingly, the CSAI-2 score could predict 62-79% winners or non-winners [Chapman *et al.* 1997; Terry, Slade 1995]. However, the authors grouped all athletes irrespective of the skill level (i.e., black, red, blue, green, yellow and white belts) [Chapman *et al.* 1997; Terry, Slade 1995] while in the present study we stratified according with the belt color/skill level (i.e. blue, purple, brown and black belts) as we expected that it had some influence on the outcomes. The fact that cognitive anxiety decreased after winning in the blue, purple, and brown groups is in line with the MTCSA predictions [Martens *et al.* 1990]. Given that the cognitive component of anxiety is thought to be influenced by sports performance (i.e.

the possibility of failing) [Besharat, Pourbohlool 2011], after winning, the fighters' anxiety about the outcome of their fights decreased. On the other hand, according to the MTCSA, somatic anxiety results from the bodily sensations linked to physiological and autonomic alterations [Martens *et al.* 1990]. Although we may not infer that winning resulted in decreased physiological alterations, one would expect that a decreased cognitive anxiety would also result in a decreased somatic anxiety, considering the influence of cognitive anxiety on physiological state and vice-versa [Besharat, Pourbohlool 2011; Fernandez-Fernandez *et al.* 2015; Fortes *et al.* 2017]. In fact, somatic anxiety also decreased in the blue, purple, and brown groups after winning the first fight, according to the magnitude-based inference analysis.

Increased anxiety and its associated physiological changes are suggested to be a stress component linked to the success seeking [Buchanan *et al.* 1999; Capranica *et al.* 2017]. It should be noted that stress and anxiety are common emotional responses in competitive sports [Filaire *et al.* 2001], and an optimum level of anxiety/stress is needed to achieve the desired competitive results [Craft *et al.* 2003]. Thus, it is possible that after winning athletes tended to change anxiety levels towards their individual optimum level. Therefore, considering the specificity of BJJ competition, in which athletes perform several fights within the same day, reducing cognitive and somatic anxiety seems to be a crucial adjustment for a fighter to continue in the competition, given that cognitive and somatic anxiety are negatively associated with sports performance [Besharat, Pourbohlool 2011; Fernandez-Fernandez *et al.* 2015].

According to MTCSA, self-confidence is linked to positive/negative thinking related to performance [Martens *et al.* 1990]. Thus, after winning an athlete likely experiences positive thinkings and increased self-confidence. Surprisingly, self-confidence increased only in the black belt group, with a possible practical effect according to the magnitude-based inference analysis. Conversely, the other groups decreased cognitive and somatic anxiety, showing no change in self-confidence after winning the first combat. According Fernandes *et al.* [2013], this result in more experienced athletes could be explained by the different interpretation of symptoms before and during the competition, such as muscle tension, nervousness and arousal. Additionally, previous studies suggested that experienced athletes present most facilitative interpretation of worry symptoms and used coping strategies with more efficiently compare to their less experienced counterparts [Mellalieu *et al.* 2004; Hanton *et al.* 2008]. Another explanation for this finding could be the win in itself, given that the initial doubt about performance outcome (e.g., worries about losing and being eliminated from the contest) vanishes. Besides that, considering the influence of psychological aspects on sports performance, strategies to enhance these are warranted. Birrer and

Morgan [2010] reviewed the literature regarding the use of traditional psychological skill training in high-intensity sports and found no conclusive evidence regarding its effects. Thus, the authors proposed a model consisting of three conceptual levels (psychological demands, skills and techniques) which would help identifying the psychological demands of each sport event and, based upon that, coaches and trainers could use a psychological technique accordingly [Birrer, Morgan 2010]. Finally, some self-skills, personal development and life skills, arousal-regulation skills, volitional skills, motivational skills and recovery skills as the most important skills to address in order to enhance performance. These could be addressed with the use of approaches such as harmonious passion, in-practice integration of volitional strategies, use of associative attention techniques, pain management techniques, and use of the mindfulness-acceptance approach and the facilitative interpretation of cognitive and somatic sensations.

In a series of studies, Hagan *et al.* [2017a; 2017b; 2017c] investigated variables associated to competitive anxiety using a sample of table tennis players. First, they investigated the influence of gender and skill level on the intensity, direction, and frequency of competitive anxiety in 90 elite and semi-elite table tennis players seven days, two days and 1 hour prior to the competition [Hagan *et al.* 2017a]. Elite female athletes presented lower cognitive anxiety, less frequent somatic anxiety, and a more facilitative interpretation of somatic anxiety compared to their male counterparts. On the other hand, no difference existed in semi-elite athletes. Self-confidence steadily rose while cognitive and somatic anxiety intensity fluctuated as competition approached. Finally, debilitative interpretation of somatic anxiety decreased 1 h before the competition and cognitive anxiety frequency increased progressively [Hagan *et al.,* 2017a]. In a subsequent study, the authors investigated the use of psychological skills in elite and sub-elite table tennis players, at the same time points of the aforementioned study (7 days, 2 days, 1 hour before competition) [Hagan *et al.* 2017b]. They found that elite athletes used self-talk, imagery and relaxation to a greater extent than sub-elite athletes. Additionally, imagery use decreased steadily across the three time points while reported usage of relaxation decreased two days before competition but increased 1h prior to the same level it was seven days before competition [Hagan *et al.* 2017b]. This result suggests two likely possibilities, non-mutually exclusive: (1) elite athlete may find psychological skill more helpful than sub-elite and/or (2) elite athletes may have more knowledge/support for applying psychological skills than sub-elite. On the third study, Hagan *et al.* [2017c] investigated the dynamic of competitive anxiety and if the dynamic would be related to deployed psychological skills during "low stressful" (i.e., preliminary rounds) and in "high stressful" condition (i.e., advance phases)

in table tennis players in a national-level competition. They found an increase in intensity and frequency of cognitive and somatic state anxiety symptoms, which were interpreted as more deliberative under high stress condition. Interestingly, self-confidence and other psychological skills were also highly displayed under the stressful condition. The authors concluded that the use of psychological skills was ineffective, regardless of the gender [Hagan *et al.* 2017c].

Considering that only the most experienced athletes showed increased self-confidence after first combat, even without changes in cognitive and somatic anxiety, while less experienced athletes showed the opposite pattern, the results of the present study suggest that competitive anxiety and self-confidence changes differently according with the graduation. It is also possible that a significant change in self-confidence in the less experienced athletes could be hindered by the fact that the athletes had to fight again a few minutes after winning their first fight (i.e. ~ 10 minutes). In an interesting study, Hanton *et al.* [2002] used a qualitative analysis to assess the retrospective perceptions and causal beliefs about temporal experiences of competitive anxiety and related symptoms in the lead up to competition in nine elite athletes, defined as currently competing internationally at major championships, such as the Olympic Games, European and World Championships (3 to 8 years; 4.73 ± 4.18 years competing in elite). Athletes were from team and individual sports, including rugby union (n = 2), soccer (n = 2), swimming (n = 3), gymnastics (n = 2) and modern pentathlon (n = 1). The data analysis suggested that intensity of cognitive anxiety symptoms remained relatively stable in the lead up to competition, whereas somatic anxiety peaked sharply at the onset of performance. Moreover, frequency of anxiety symptoms increased as the competition approached and changes in interpretation of anxiety symptoms were also reported, with self-confidence identified as a moderating variable. Therefore, once greater self-confidence is positively associated with competitive success [Besharat, Pourbohlool 2011; Fortes *et al.* 2016] investigations on the determinants of self-confidence in combat sports athletes are warranted, especially considering that differences according to graduations (i.e. belt color) may exist.

The fact that no correlation between self-confidence, cognitive and somatic anxiety was found are not in line with the predictions of the MTCSA [Martens *et al.* 1990] and contra poses the results of previous studies [Martens *et al.* 1990; Fernandes *et al.* 2013; Fortes *et al.* 2017]. It is important to highlight the analysis performed in those studies included athletes irrespective of their skill level (i.e. belt color). One possible explanation for this result is the heterogeneous sample involved in the analyzes including all groups which possibly could result in conflicting findings [Craft *et al.* 2003]. Also, this find reinforces an important of continuous analyzes of athlete during the competition and what changes could be occur phase by phase.

The strengths of the present study include the assessment of competitive anxiety and self-confidence in combat sports in a high ecological setting of "real life" competition, including different skills levels (i.e. belt color) and multiple-assessments. The limitations of the present study include the assessment of a sample composed only by male athletes, the limited sample size for the comparison of the first and second fight, and the cross-sectional nature, which does not allow establishing cause-effect relationship. It is worth mentioning that only men were included given that previous studies showed differences between competitive anxiety and self-confidence between men and women [Martens *et al.* 1990; Fernandes *et al.* 2013]. Thus, studies with women are warranted. In addition, the inclusion of measures of neuroendocrine variables, such as cortisol, could help to understand the psychophysiological effects of competition induced changes in competitive anxiety and self-confidence. We also recommend future investigations to include qualitative (i.e. content analysis) or mixed research approaches (i.e. quantitative and qualitative) to assess competitive anxiety and self-confidence as well as their determinants and impact on competition performance/outcome. Furthermore, future field studies should consider combining the CSAI-2R with psycho-physiological assessments (e.g., heart rate variability).

Conclusion

BJJ athletes with varying skills levels present similar competitive anxiety and self-confidence immediately the first fight. However, after winning cognitive and somatic anxiety decreased in the less skilled groups (i.e. blue, purple, and brown belt) and self-confidence increased only in the most experienced group (i.e. black belt), suggesting that psychological skills such as anxiety and self-confidence may work differently depending on the athlete's skill.

In this regard, understanding how athletes control their emotions and cope with unpleasant/undesired feelings might be determinant for their performance during fights and crucial for winning the championship, considering BBJ's contest format (i.e. multiple combats within the same day). Decrease of worry and/or doubt about performance (i.e. cognitive anxiety) and jitters (i.e. somatic anxiety) might be the key for good performances, especially in less experienced athletes, which could be present lower mental abilities under pressure (i.e. competition environment). For more experienced fighters, self-efficacy even when fatigued might fundamental to remain focused and competitive. From a

practical perspective, athletes should train their mental abilities, especially the self-control, considering the high levels of pressure during a BJJ's championship.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

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Porównanie poziomu lęku przed zawodami i pewności siebie wśród brazylijskich zawodników Jiu-Jitsu o różnym stopniu umiejętności: przekrojowe studium przypadku w trakcie wydarzeń sportowych

Słowa kluczowe: Brazylijski jiu-jitsu, lęk, pewność siebie, walka sportowa, psychologia sportu

Streszczenie:

Tło. Na lęk przed zawodami i pewność siebie może mieć wpływ szereg czynników, w tym poziom umiejętności i zmiany w trakcie wydarzeń sportowych. Jednak zmiany zachodzące w trakcie wydarzeń sportowych są nieoczywiste.

Problem i cel. Celem autorów było porównanie poziomu lęku i pewności siebie podczas zawodów wśród brazylijskich zawodników Jiu-Jitsu (BJJ) o różnych kolorach pasów i porównanie ich w czasie pierwszej i drugej walki. Badanie objęło stu trzynastu zawodników BJJJ (26,6 ± 5,36 roku) startujących w otwartych mistrzostwach Brazylii Jiu-Jitsu w 2017.

Metody. Ankietowani odpowiadali na pytania zawarte w Inwentarzu Stanu i Cech Lęku (CSAI-2R) po ważeniu i 15 minut przed pierwszą walką, a ci, którzy wygrali, odpowiadali ponownie przed drugą walką. Analizie poddano lęk poznawczy, lęk somatyczny i stan pewności siebie. Przeprowadzono test hipotezy całkowitej oraz analizę wnioskowania na podstawie wielkości.

Wyniki. Zawodnicy z grupy posiadającej czarny pas byli starsi i bardziej doświadczeni (p<0,05). Nie stwierdzono istotnych różnic między zawodnikami o różnych kolorach pasów w kategorii lęku poznawczego i somatycznego oraz pewności siebie (p>0,05). Po wygranej nastąpił spadek lęku poznawczego i somatycznego w grupach zawodników o pasach niebieskich, fioletowych i brązowych, natomiast jedynie grupa posiadaczy czarnych pasów zwiększyła pewność siebie.

Wnioski. Autorzy stwierdzają, że poziom umiejętności nie wpłynął na stan lęku i pewności siebie w sportach walki, ale wpłynął na to, jak zmienił się w trakcie zawodów.