

Original Article

Mastery goals are associated with training effort in Brazilian jiu-jitsu

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Abstract

Problem statement: Brazilian jiu-jitsu (BJJ) is a grappling-based combat sport with a high attrition rate. Central to BJJ training is simulated competition in the form of sparring, which may have implications for athlete motivation and effort in training, and consequently impact skill development and sport adherence. Thus, the aim of this study was to

Approach: Twelve active male athletes (age: 30.6 ± 2.7 (SD) years; height: 182.5 ± 5.9 cm; body mass: 81.2 ± 6.7 kg; training experience: 4.6 ± 2.2 years; weekly training duration: 10.3 ± 4.4 hours) ranked from white to brown belt were monitored during sparring in a BJJ training session. Perceptual training effort was expressed using rating of perceived exertion (RPE) and physiological training effort was determined with relative heart rate (HR) responses. Achievement goal profiles and perceptions of the motivational climate were assessed with the 3x2 Achievement Goal Questionnaire for Sport (3x2 AGQ-S) and the Perceived Motivational Climate in Sport Questionnaire (PMCSQ-2), respectively.

Purpose: Explore the relationship between perceptual and physiological markers of training intensity and achievement motivation in active BJJ athletes.

Results: The athletes reported a mean absolute RPE of 15 ± 1 during sparring, which equated to a relative RPE of 74 ± 7 percent. Mean HR was 164 ± 9 beats·min⁻¹, equivalent to 85 ± 4 percent of the athletes' maximal HR. Perceived effort strongly correlated with task- and self-approach goals, as well as other-avoidance goals ($p < 0.05$). Similar associations were observed for HR and the two latter goal constructs ($p < 0.05$).

Conclusions: These observations indicate that mastery-based goals are associated with training effort in BJJ, consistent with previous findings on the mastery-effort relationship. Emphasizing mastery-oriented goals and motivational climates may increase long-term adherence to BJJ and be conducive to mastery involvement during training.

Keywords: combat sports; martial arts; grappling; achievement goal theory; achievement behaviour; motivational dynamics

Introduction

Sparring is an integral component of combat sports training. It involves two athletes simulating competition under a specific ruleset or restricted to certain scenarios. Resultantly, the capabilities of one athlete is directly measured against those of another, with the specific challenges and subsequent training adaptations being dependent on discrepancies in skill, physical capacity, and effort. As opposed to combat sports with striking elements, sparring in grappling-based sports such as Brazilian jiu-jitsu (BJJ) can be performed at a high intensity with a comparably low risk of serious injuries, especially to the head. Although the importance of technique is often emphasized in BJJ, high-intensity efforts constitutes a significant part of both simulated and official competition (L. V. Andreato, Follmer, Celidonio, & Honorato, 2016). However, since winning is not intrinsically related to effort, the intensity at which BJJ is practiced, particularly in non-competitive settings, varies considerably among athletes, in part as a function of variations in technical proficiency and competitive aspirations.

For the past three decades, achievement goal theory (AGT) has emerged as a prominent theoretical perspective for investigating engagement in achievement settings, such as in sports training and competition. The theory builds on the dichotomy between mastery and performance, where mastery goals relates to developing competence while performance goals relates to demonstrating competence (Ames, 1992; Nicholls, 1979, 1984). Early theoretical models were mostly limited to these two constructs, but subsequent distinctions of approach and avoidance temperaments has resulted in more nuanced AGT frameworks, such as the recent 3x2 model (Elliot, Murayama, & Pekrun, 2011; Masciet, Elliot, & Cury, 2015). Achievement goal orientations can be studied as traits or states (Kaplan & Maehr, 2007), where the latter is the product of traits and factors at the contextual level, *i.e.* the surrounding motivational climate. As opposed to dispositional goal orientations, the involvement state is subject to constant change during a training session (Gernigon, d'Arripe-Longueville,

Delignières, & Ninot, 2004). Mastery-oriented athletes are likely to display adaptive behaviour, such as effort and persistence, independent of perceived ability. Thus, the characteristics of an athlete's achievement motivation may have major short- and long-term implications for success in and adherence to their sport.

Given the inherent competitive nature of sparring, it offers a unique context in which to investigate achievement goals, climate perceptions, and training intensity. Insight into these relationships may contribute to an understanding of the high attrition rate in competitive combat sports such as BJJ and uncover potential training-related differences among mastery- and performance-oriented athletes. Thus, the aim of this study was to investigate the relationship between effort in BJJ sparring, achievement goals, and perceptions of the training climate. We hypothesized that mastery goals would be associated with subjective and objective markers of effort and that goal orientations would reflect perceptions of the motivational climate.

Materials and Methods

Study design

Athletes were randomly selected from a larger cross-sectional study sample (Ovretveit, 2018b) for training intensity measurements. Perceptual and physiological markers were measured for five consecutive 6-minute sparring rounds separated by 90-second breaks against opponents of varying ranks, using instruments and procedures described elsewhere (Ovretveit, 2018a). Rating of perceived exertion (RPE) was used as a marker for perceptual effort and heart rate (HR) was used as a marker for physiological effort. Overall training effort was calculated as the average intensity of all rounds. Both effort markers were expressed as absolute and relative numbers; relative RPE as a fraction of its theoretical maximal of 20 and relative HR as a fraction of each athlete's individual maximal as determined by an incremental cardiopulmonary exercise test.

Participants

Twelve male BJJ athletes 30.6 ± 2.7 years old, 182.5 ± 5.9 cm tall and weighing 81.2 ± 6.7 kg participated in this study. They were ranked from white to brown belt, with an average training experience of 4.6 ± 2.2 years and a weekly training duration of 10.3 ± 4.4 hours. The study was approved by the local ethics committee. The athletes provided written informed consent prior to their participation.

Measurement procedures

Achievement goal orientations were measured with the 3x2 Achievement Goal Questionnaire for Sport (3x2 AGQ-S) (Mascret et al., 2015). Perceptions of the motivational climate were assessed with the Perceived Motivational Climate in Sport Questionnaire (PMCSQ-2) (Newton, Duda, & Yin, 2000). Both questionnaires were completed in an individual, supervised setting prior to the training session (Ovretveit, Saether, & Mehus, 2018). During sparring, HR was continuously monitored with a HR sensor (H7, Polar Electro, Finland) linked to a supervised watch (M400, Polar Electro, Finland). Borg's (1970) 15-point RPE scale was used to assess perceptual effort. All athletes were familiarized with the measurement procedures prior to the training session.

Statistical analyses

Statistical analyses were performed using IBM SPSS version 25 (Chicago, IL, USA). Figures were made with GraphPad Prism version 6 (San Diego, CA, USA). Data normality was assessed with the Shapiro-Wilk test and Q-Q plots. Pearson product-moment correlation coefficients were calculated to determine questionnaire intercorrelations and the relationships between achievement goals and effort markers. Coefficients of ≥ 0.1, ≥ 0.3, and ≥ 0.5 were considered as small, moderate, and large correlations, respectively (Cohen, 1988). The paired samples *t*-test was used to compare motivational climate perceptions. A *p* < 0.05 was considered statistically significant.

Results

Achievement goal scores and intercorrelations are presented in table 1. The athletes reported a mean absolute RPE of 15 ± 1 (range: 13 – 17) during sparring, which equated to a relative RPE of 74 ± 7 percent (range: 65 – 85). Mean HR was 164 ± 9 beats · min⁻¹ (range: 149 – 183), equivalent to 85 ± 4 percent (range: 76 – 90) of the athletes' maximal HR. Several large correlations were observed between RPE and achievement goal orientations; these are shown in figure 1. Similarly, relative HR was strongly associated with both self-approach (*r* = 0.65, *p* < 0.05) and other-avoidance (*r* = 0.66, *p* < 0.05) goals.

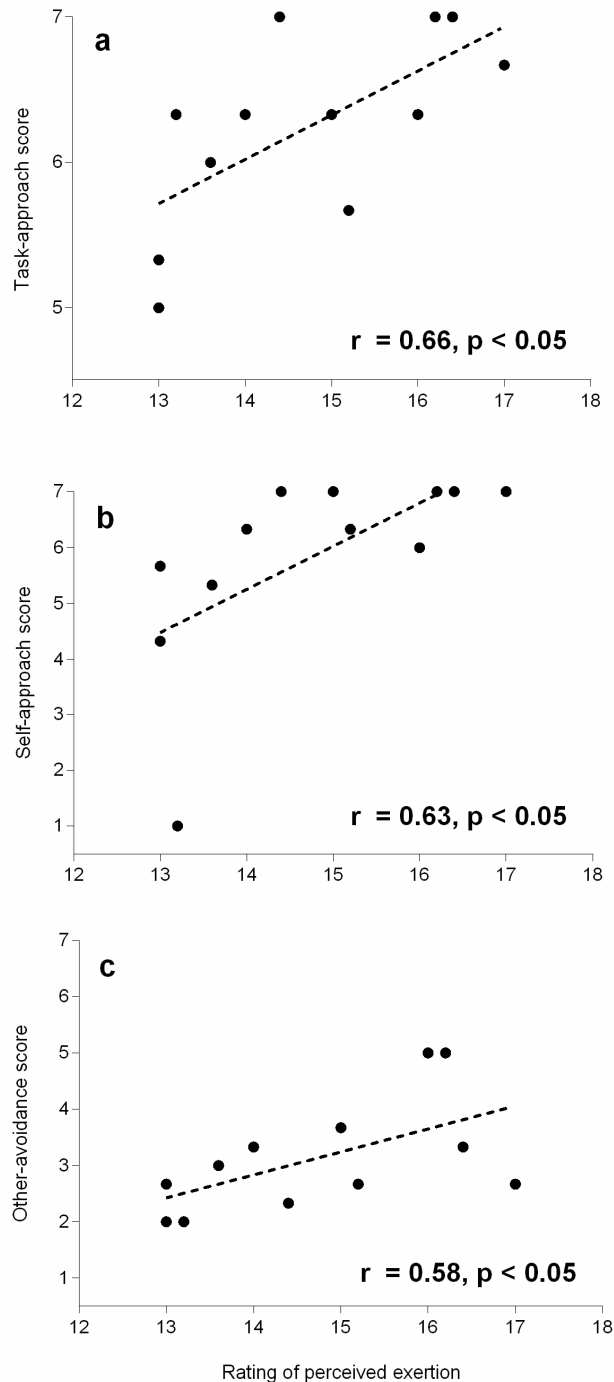
Table 1. Achievement goal scores and intercorrelations

	Score	Scale	1	2	3	4	5	6
1. Task-approach	6.3 ± 0.7	1 - 7	–					
2. Task-avoidance	4.7 ± 1.4	1 - 7	0.65*	–				
3. Self-approach	5.8 ± 1.7	1 - 7	0.38	0.59*	–			
4. Self-avoidance	4.3 ± 2.0	1 - 7	0.56	0.88**	0.72**	–		
5. Other-approach	3.6 ± 0.8	1 - 7	-0.40	-0.23	0.13	-0.14	–	
6. Other-avoidance	3.1 ± 1.0	1 - 7	0.42	0.23	0.47	0.36	0.43	–

* *p* < 0.05; ** *p* < 0.01

Figures

Figure I. Correlations between goal orientations and perceived exertion



The athletes perceived the climate as significantly more mastery (3.9 ± 0.7) than performance (1.8 ± 0.3) oriented ($p < 0.001$). All subscale scores were associated with their higher-order scale. No relationships were detected between overall perceptions of the motivational climate and neither training effort nor goal orientations ($p > 0.05$). Among the subscales, important role was found to correlate with RPE ($r = 0.61, p < 0.05$) and task-approach goals ($r = 0.70, p < 0.05$). All subscale scores and correlation with higher-order climate scales are presented in table 2.

Table II. Motivational climate subscale scores and higher-order scale correlations

	Score	Scale	Mastery climate <i>r</i>	Performance climate <i>r</i>
Cooperative learning	4.0 ± 0.9	1 - 5	0.90**	-0.31
Important role	3.8 ± 0.8	1 - 5	0.95**	-0.29
Effort/improvement	3.9 ± 0.6	1 - 5	0.91**	-0.31
Punishment for mistakes	1.6 ± 0.4	1 - 5	-0.45	0.81**
Unequal recognition	1.8 ± 0.4	1 - 5	-0.53	0.68*
Intra-team member rivalry	2.2 ± 0.4	1 - 5	0.25	0.75**

* $p < 0.05$; ** $p < 0.01$

Discussion

To the best of our knowledge, this is the first study that examines the relationship between training effort and achievement goal orientations in BJJ athletes. Our main finding was that both perceptual and physiological markers of training effort were strongly associated with mastery-approach goals, indicating that mastery-oriented athletes aim for a high training intensity in BJJ sparring. Since goal orientation scores pertain to the athlete's overall purposes of achievement behaviour (Kaplan & Maehr, 2007), adopting self-referenced and task-referenced mastery as the predominant training goals may be conducive to voluntary exertion during combat and consequently physiological and technical-tactical training adaptations. Indeed, the belief that effort is related to outcome is fundamental in goals of mastery (Ames, 1992).

Interestingly, the athletes rated their effort lower than what was indicated by their HR. This discrepancy is in agreement with the findings of others (L. V. Andreato et al., 2016; L. V. Andreato et al., 2015) and is likely partly caused by overestimated HR due to the intensity characteristics, body position, and repetitive isometric contractions during BJJ combat (Ovretveit, 2018a). In general, RPE is considered a reliable method for intensity assessments in combat sports (Slimani, Davis, Franchini, & Moalla, 2017). Moreover, since achievement goal items and perceived exertion were both subjectively rated by the athletes, the relationship between these ratings may offer a unique perspective on the motivation behind a high intensity training effort. Despite reflecting slightly different levels of training intensity, HR and RPE displayed similar relationships with goal orientations with the exception of task-approach goals. While RPE had a large correlation with task-approach goals, HR did not. Self-approach goals, which both markers showed strong and significant relationships with, are focused on obtaining self-based competence ("to do better than what I usually do"; "to have better results than I had in the past"; "to be more effective than before") whereas task-approach goals are focused on obtaining task-based competence ("to perform well"; "to obtain good results"; "to be effective") (Mascret et al., 2015). Since RPE is not bound by physiological constraints it may in certain contexts be a more accurate reflection of conscious effort than HR. However, a larger sample is required to elucidate marker-specific differences in the effort-mastery relationship.

Providing some nuance to the apparent role of mastery goals were the other-avoidance goals, which correlated with both RPE and HR. These goals relate to normative performance and the goal of not performing worse than others. Performing "worse" than an opposing teammate in BJJ sparring is essentially being exposed to physical harm by being placed in a submission hold or dominated positionally and lose in a competitive sense. However, BJJ athletes are expected to frequently experience and learn from being inferior (Ribeiro & Howell, 2008). Thus, a significant relationship between sparring effort and the goal of avoiding a loss may ostensibly be surprising. Indeed, by simply engaging in sparring against more experienced and/or larger opponents, athletes to some extent expect and accept losing. However, this observation is likely reflective of the fact that some athletes are actively attempting to avoid defeat via increased effort; those who consider it crucial to avoid defeat work hard to achieve just that. Accordingly, although emphasising avoidance goals could impact long-term adherence negatively, it could be speculated that if avoidance goals drive training effort they may also lead to increased skill and thereby ultimately improve adherence.

In line with our second hypothesis, the goal orientation profiles were consistent albeit not significantly correlated with perceptions of the motivational climate. It is well established that mastery-oriented motivational climates promote adaptive patterns of engagement in achievement settings (Ntoumanis & Biddle, 1999). Longitudinal studies of elite grapplers show that dropouts perceive the motivational climate created by coaches, peers, and parents as less mastery- and more performance-involving than persisting athletes (Le Bars, Gernigon, & Ninot, 2009). Thus, facilitating a mastery-oriented climate likely has a positive influence on adherence in grappling sports such as BJJ. In the present study, overall perceptions of the motivational climate did not appear to relate to training effort. Among the climate subscales, important role, a component of a mastery-oriented climate, was positively associated with RPE and task-approach goals. This scale consists of items related to an athlete's value in a team, which is seemingly more appropriate for athletes engaged in team sports. However, BJJ academies tend to have a strong sense of team despite the individual nature of competition. Indeed, teammates play a critical role in training, both in technical drilling and sparring. Active competitors are particularly dependent on reliable training partners with varying levels of skill and of different sizes to prepare them for competition. Novice grapplers such as white and blue belts can be resourceful training partners for the considerably more advanced brown and black belts, for instance by being less technically proficient and thereby

offering low-risk opportunities to refine offensive techniques. Conversely, lower belts are forced to develop their defence when sparring with higher belts in training. Indeed, a diverse group of training partners is essential to create a valuable dynamic for the development of different aspects of BJJ, an assumption that is supported by the high score on the important role subscale and its observed relationship with perceptual training effort.

Limitations to the present study include the cross-sectional study design, which cannot establish cause-effect relationships. Thus, it has yet to be determined whether goals of mastery influence training intensity, or if BJJ creates or selects for mastery-oriented athletes. Furthermore, the study sample was small, yet our findings on achievement motivation are consistent with those from larger samples (Ovretveit et al., 2018). The athletes were recruited from a fairly homogeneous population at the same academy where the motivational climate is generally perceived as mastery-oriented. However, we observed a wide range in both perceptual and physiological training responses in our cohort. Larger studies are required to confirm the mastery-effort relationship in BJJ. Intervention studies targeting a shift in athlete motivation may be appropriate to assess the effects on attrition rate as well as on physiological adaptations. Although BJJ athletes appear to have modest physical performance characteristics (Leonardo Vidal Andreato, Lara, Andrade, & Branco, 2017; Ovretveit, 2018b), they have demonstrated considerable improvements when exposed to resistance (Ovretveit & Toien, 2018) and endurance training (Ovretveit, 2019), indicating a considerable physiological improvement potential, which may in part be influenced by the mastery-effort relationship.

Conclusions

Consistent with previous research, a mastery goals and training effort appears to be firmly associated in BJJ athletes. Emphasizing mastery-oriented goals and motivational climates may increase long-term adherence to BJJ and be conducive to mastery involvement during training. This could have implications for physiological and technical-tactical training adaptations, competition success, and rank progression.

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