

Effects of a sport competition on acute affective response in wheelchair basketball players

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The purpose of this study was to investigate the effects of sport game outcomes on acute affective responses in injured veterans. Twenty-three wheelchair basketball players (mean age, 38.39 ± 11.78 years) participated in this study and were divided into two groups: game winner group ($n=12$) and game loser group ($n=11$). All participants completed the Physical Activity Affect Scale immediately before and after participation in the first game of a wheelchair basketball tournament. Non-parametric statistical tests were used to examine a significant difference in acute affective responses between the groups and over time

within each group. The losers experienced significantly higher negative affect and lower positive affect at the end of the first game compared to the winners. Therefore, the results of the present study indicated that the experience of losing may diminish the positive effect that sport participation can have.

Keywords: Sport competition, Injured veterans, Acute affective responses, Winners, Losers


INTRODUCTION

Since Dr. James Naismith introduced basketball to the public in 1891 at the Young Men's Christian Association, individuals with and without disabilities have been playing basketball to improve their positive affect (PA) and to regulate their negative affect (NA). According to Driver and Lox (2007), affect means a temporary feeling state coming from a particular stimulus, whereas mood means a long-lasting feeling state not coming from a specific stimulus. Russell (1980) stated that affective feeling states consist of the different combinations of valence (pleasure to displeasure) and activation (arousal to sleepiness). The circumplex model of affect includes the four quadrants: PA (positive-high arousal), tranquility (TR; positive-low arousal), NA (negative-high arousal), and fatigue (FA; negative-low arousal). Acute affective responses to physical activity can be assessed by the Physical Activity Affect Scale (Lox

et al., 2000). Indeed, the four components of acute exercise-induced affect (i.e., PA, TR, NA, and FA) can be assessed by the Physical Activity Affect Scale.

Participation in physical activity can play a central role in enhancing positive affective feelings (i.e., PA and TR) and in reducing negative affective feelings (i.e., NA and FA), as demonstrated by the existing literature (Driver and Lox, 2007; Kwan and Bryan, 2010; Magnan et al., 2013; Pittsinger et al., 2017). Pittsinger et al. (2017) investigated the effect of surfing on acute affective responses in the adults. The acute affective responses in the participants were measured prior to and immediately after the 30-min surfing session in the ocean. The participants reported notable improvements in PA and TR after surfing, while they reported notable reductions in NA and FA after surfing. According to Bandura (2001), social cognitive theory is the theoretical model describing human behavior as the result of reciprocal interaction of

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personal, behavioral, and environmental influences (e.g., personality, cognitive processing or reasoning in a positive way, observational learning from team norms or a role model, social reinforcement, and punishment). The previous researchers mentioned that cognitive appraisal (e.g., high self-efficacy level) has an influence on acute affective responses perceived by individuals (Ekkekakis, 2003; Ekkekakis and Petruzzello, 1999; Magnan et al., 2013). Individuals could recognize more positive feelings and less negative feelings during sport competition and exercise, if they were exposed to more successful experiences.

Driver and O'Connor (2003) evaluated the effects of an 8-week exercise program on affective responses for adults with brain injuries. The participants in the exercise program experienced a significant increase in PA and TR and a significant reduction in NA and FA relative to the control group. In addition, Driver et al. (2003) investigated the effect of an aquatic exercise program on affective responses in adults with brain injuries. The participants experienced a significant increase in PA and TR, while they experienced a significant decrease in NA and FA. These research studies support the conclusion that participation in physical activity has a positive impact on affective experience in individuals with disabilities.

In the recent research, Hwang et al. (2018) compared the changes in acute affective responses across two groups of the injured veterans. The active injured veterans in both groups reported high positive affective feelings (i.e., PA and TR) and low negative affective feelings (i.e., NA and FA) at the start of their daily physical activity. The participants who engaged in a full day of noncompetitive activity reported increased PA, TR, and FA, whereas the participants who engaged in competitive activity reported decreased PA and increased FA. In addition, Yeatts et al. (2019) investigated the impact of game outcome on acute affective responses in the military wheelchair basketball players. The participants were divided into winner and loser groups. Whereas the winners experienced increased PA and TR and decreased NA, the losers experienced decreased PA and TR and increased NA. Yeatts et al. (2019) suggest that the experience of losing in competition might diminish the positive benefits of physical activity on acute affective responses in the players.

Sport competition has been used for injured veterans as a vehicle to improve their positive affective feelings and to regulate their negative affective feelings since Dr. Ludwig Guttmann utilized sports to rehabilitate injured veterans after World War II. However, the experience of a loss in sport competition may negatively influence acute affective responses in injured veterans. Few re-

search studies have evaluated whether sport game outcome has a positive impact on acute affective responses in the injured veterans. Therefore, the purpose of this study was to examine the effects of sport game outcome (i.e., winning or losing) on acute affect responses in the injured veterans. It was hypothesized that a win or a loss after the first game of a wheelchair basketball conference would not influence four acute affective dimensions in the injured veterans.

MATERIALS AND METHODS

Participants

Twenty-three players from a Military Wheelchair Basketball Conference participated in this study (mean age, 38.39 ± 11.78 years; mean body mass index, 24.18 ± 5.69 kg/m²). All participants were injured, ill, and/or wounded members of the United States military. Twenty players (87%) were males, and three players (13%) were females as shown in Table 1. The players were injured veterans of the U.S. Army, Navy, Air Force, and Marine Corps. They engaged in wheelchair basketball practices for more than 2 hr per week over the past 2 years. The players experienced one of the following disabilities during their military service: physical disabilities (PD such as spinal cord injuries and amputations), posttraumatic stress disorder (PTSD), or a combination of multiple disabilities (PD+PTSD). The players reported that they had participated in physical activity more than 150 min per week at a moderate intensity for the previous three months. The players on each team participated in their first wheelchair basketball game

Table 1. Characteristics of participants

Variable	All players (N=23)	Game winners (n=12)	Game losers (n=11)
Age (yr)	38.39 ± 11.78	35.08 ± 10.08	42.00 ± 12.88
Gender			
Male	20 (87)	10 (83)	10 (91)
Female	3 (13)	2 (17)	1 (9)
Height (cm)	177.84 ± 12.77	178.54 ± 10.05	177.08 ± 15.69
Body weight (kg)	77.09 ± 21.64	71.50 ± 20.37	83.19 ± 22.26
BMI (kg/m ²)	24.18 ± 5.69	22.15 ± 5.04	26.40 ± 5.75
Diagnosis			
PD	20 (87)	11 (92)	9 (82)
PD+PTSD	2 (9)	1 (8)	1 (9)
PTSD	1 (4)		1 (9)

Values are presented as mean ± standard deviation or number (%).

BMI, body mass index; PD, physical disabilities; PTSD, posttraumatic stress disorder.

9 a.m. to noon on one of the two basketball courts (i.e., 10-min quarters, a 2-min break between quarters, and a 5-min halftime break for each game). The sample was divided into two groups: game winner group (GWG, $n = 12$) and game loser group (GLG, $n = 11$) following each team's first game.

Experimental procedure

All participants individually completed the survey instrument prior to and immediately following the first game of each team. Three research assistants met with each team for a brief presentation on the survey instrument during warm-ups on the court sideline prior to the start of the first game. Explanations were provided by the research team to clarify any concerns about the survey instrument or its wording. The survey instrument was presented on a clipboard out of sight of the other participants and the responses were recorded. All procedures were approved by the Institutional Review Board (IRB) of Texas Woman's University (IRB protocol #18138).

Measurement

The demographic questionnaire was used to collect each participant's age, gender, type of disability, physical activity level over the past three months, and height and weight information as shown in Table 1. The Physical Activity Affect Scale (Lox et al., 2000) was used to assess each participant's four acute affective dimensions (i.e., exercise-induced feeling states): PA (energetic, enthusiastic, and upbeat, $\alpha = 0.84$), NA (awful, crummy, and discouraged, $\alpha = 0.78$), TR (calm, relaxed, and peaceful, $\alpha = 0.82$), and FA (fatigued, tired, and worn-out, $\alpha = 0.86$). The acute affective responses for each participant were rated on a 5-point scale (0 = do not feel to 4 = feel very strongly). The scores for each dimension were averaged to assess the level of the participant's acute affective response within each dimension. The scores for NA and FA were reversed scoring (e.g., lower scores indicate better exercise-induced feelings).

Sample size and data analysis

Sample size was determined using G*Power program (Faul et al., 2007), which calculated the sample with a priori effect size (1.50) of $f^2(V)$, the probability of a Type-I error ($\alpha = 0.05$), the probability of a Type-II error ($1 - \beta = 0.95$), and the allocation ratio ($N2/N1$), respectively. The GraphPad Prism ver. 9.3.1 (Graph Pad Software, San Diego, CA, USA) was used to test a difference in acute affective responses between the two groups and a change in acute affective responses within the players on the same group

across times. All data were presented as mean \pm standard deviation, and normal distribution was tested using the Shapiro–Wilk test. The Mann–Whitney U -test was used to examine a significant difference between the groups for acute affective responses (i.e., PA, NA, TR, FA). The Wilcoxon signed-rank test was used to examine a significant change in acute affective responses within the players on the same team (i.e., pre-post change). In addition, the effect size was calculated to determine the practical significance of research findings in player affective responses using the Hedges' g . The small, medium, and large effect sizes were considered as 0.2, 0.5, and 0.8, respectively (Cohen, 1992). Statistical significance was set at $P \leq 0.05$.

RESULTS

Baseline characteristics of acute affective dimensions

Twenty-three participants were divided into the two groups: GWG and GLG. No statistically significant difference was identified prior to the beginning of the first game (i.e., prevalue) for PA, NA, TR, and FA between the two groups.

Effects of a basketball competition on PA

There was no significant difference in PA before participation in the game ($Z = -0.532$, $P = 0.608$, $g = 0.21$) between GWG (3.20 ± 0.50) and GLG (3.06 ± 0.79). After participation in the game, the PA score of GWG increased (3.44 ± 0.36 ; $Z = -1.569$, $P = 0.117$), but not significantly increased as compared with the prevalue.

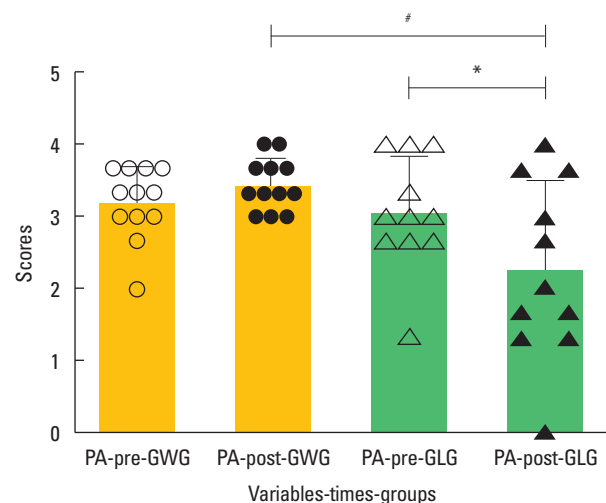


Fig. 1. The difference in positive affect between GWG and GLG. PA, positive affect; GWG, game winner group; GLG, game loser group. * $P \leq 0.05$, change in PA from prevalue to postvalue. # $P \leq 0.05$, difference in PA between GWG and GLG.

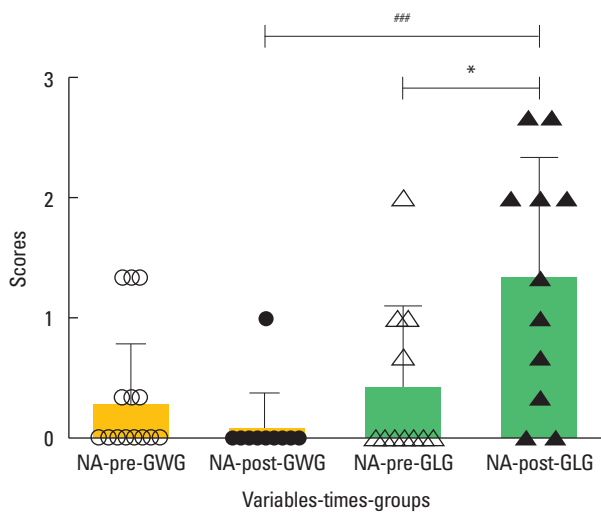


Fig. 2. The difference in negative affect between GWG and GLG. NA, negative affect; GWG, game winner group; GLG, game loser group. * $P \leq 0.05$, change in NA from prevalue to postvalue. $^{***}P \leq 0.001$, difference in NA between GWG and GLG.

However, the PA score of GLG was significantly decreased (2.27 ± 1.24 ; $Z = -2.255$, $P = 0.024$) compared with the prevalue. In addition, a significant difference was identified in the PA score between the two groups at the end of the game ($Z = -2.272$, $P = 0.023$, $g = 1.30$). Specifically, the PA score of GWG was significantly higher as compared to the score of GLG at the end of the game (Fig. 1).

Effects of a basketball competition on NA

No significant difference was observed in NA before participation in the game ($Z = -0.290$, $P = 0.833$, $g = 0.23$) between GWG (0.28 ± 0.51) and GLG (0.42 ± 0.67). After participation in the game, the NA score of GWG decreased (0.08 ± 0.29 ; $Z = -1.105$, $P = 0.269$), but not significantly reduced when compared with the prevalue. However, the NA score of GLG was significantly increased (1.33 ± 1.00 ; $Z = -2.153$, $P = 0.031$) as compared with the prevalue. In addition, a significant difference was revealed in the NA score between the two groups at the end of the game ($Z = -3.438$, $P = 0.001$, $g = 1.73$) as illustrated in Fig. 2. More specifically, the NA score of GLG was significantly higher compared to the score of GWG at the end of the game.

Effects of a basketball competition on TR

No significant difference was reported in TR before participation in the game ($Z = -0.437$, $P = 0.695$, $g = 0.18$) between GWG (2.97 ± 0.75) and GLG (2.82 ± 0.87). After participation in the game, the TR score of GWG (2.83 ± 1.14 ; $Z = -0.298$, $P = 0.766$)

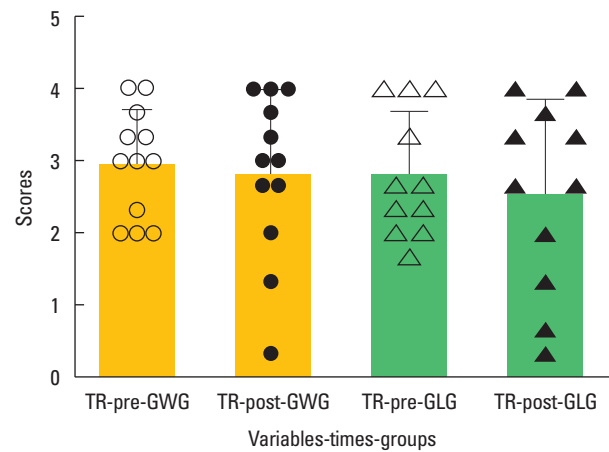


Fig. 3. The difference in tranquility between GWG and GLG. TR, tranquility; GWG, game winner group; GLG, game loser group.

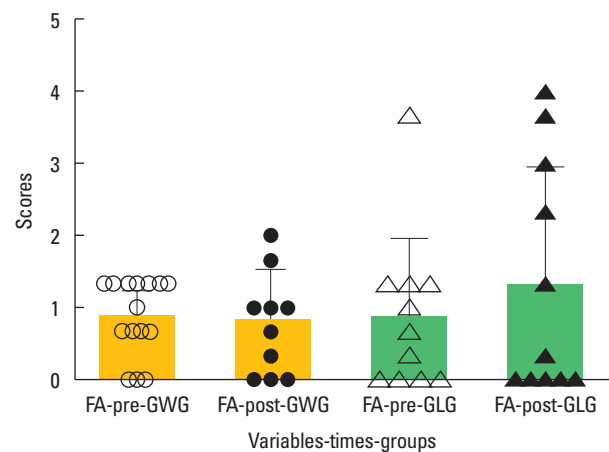


Fig. 4. The difference in fatigue between GWG and GLG. FA, fatigue; GWG, game winner group; GLG, game loser group.

and GLG (2.55 ± 1.30 ; $Z = -0.831$, $P = 0.406$) decreased, but not significantly changed when compared with the prevalue. Also, there was no significant difference in the TR score between the two groups at the end of the game ($Z = -0.497$, $P = 0.651$, $g = 0.22$) as displayed in Fig. 3.

Effects of a basketball competition on FA

There was no significant difference in FA before participation in the game ($Z = -0.771$, $P = 0.487$, $g = 0.04$) between GWG (0.92 ± 0.51) and GLG (0.88 ± 1.09). After participation in the game, although the FA score of GWG decreased (0.86 ± 0.67 , $Z = -0.205$, $P = 0.838$) and that of GLG increased (1.33 ± 1.62 , $Z = -0.842$, $P = 0.400$), those were not significantly changed as compared with the prevalues. In addition to these results, no significant difference

was identified in the FA score between the two groups at the end of the game ($Z = -0.126$, $P = 0.928$, $g = 0.38$) as shown in Fig. 4.

DISCUSSION

The purpose of this study was to examine how sport game outcome (i.e., winning or losing) influences acute affect responses of the injured veterans. It was hypothesized that the experience of a win or a loss after the first game of a wheelchair basketball tournament would not have an impact on acute affective responses in the injured veterans. The results of Mann–Whitney and Wilcoxon tests rejected the null hypothesis of the current study as statistical significance was observed for the following acute affective components. The losers experienced a significant decrease in PA and a significant increase in NA after the first game. The winners experienced significantly higher PA at the end of the first game, while they experienced significantly lower NA compared to the losers. These major findings of the current study are similar to those reported in the previous literature related to acute affective responses to sport competition in the participants (Hwang et al., 2018; Jones and Sheffield, 2007; Yeatts et al., 2019).

According to Russell (1980), the circumplex model of affect consists of the four quadrants: PA (positive-high arousal), TR (positive-low arousal), NA (negative-high arousal), and FA (negative-low arousal). Immediately after the first game, the losers reported a significant decrease in PA and a significant increase in NA. To assess the practical meaningfulness of the results in the present study, effect sizes were calculated using the Hedges' g formula for affective components (Cohen, 1992). Large effect sizes indicated a meaningful change in PA and NA of the losers. The unpleasant affective experience (i.e., the experience of a loss) in the losers increased negative-high arousal (i.e., NA) and decreased positive-high arousal (i.e., PA). However, the winners reported significantly higher PA and lower NA at the end of the first game as compared to the losers. In terms of meaningful differences, PA and NA appeared to have large effect sizes. Among the winners the pleasant affective experience (i.e., the experience of a win) during competition improved positive-high arousal (i.e., PA) and reduced negative-high arousal (i.e., NA).

Bandura (2001) mentioned that social cognitive theory is the theoretical model representing self-efficacy. Other researchers reported that cognitive appraisals (e.g., high self-efficacy level) have an impact on acute affective responses experienced by individuals (Ekkekakis, 2003; Magnan et al., 2013). Through sport and exercise sessions, individuals could perceive more positive feelings and

less negative feelings if they were exposed to more positive stimuli (e.g., positive rewards or successful experiences). One possible explanation for higher NA and lower PA in the losers is that the experience of a loss in competition may lower their self-efficacy level which negatively influences their acute affective responses. Although the losers were strongly expecting to get a championship trophy after a series of wheelchair basketball practices over one year, the unsuccessful experience after the first game might negatively change their acute affective responses.

Reed and Ones (2006) stated that exercise settings, exercise intensity, and previous physical activity level may influence acute affective responses in individuals. As the result of positive and negative stimuli during sport competition, individuals may experience acute positive or negative feelings. Hwang et al. (2018) proposed that physical activity in a noncompetitive setting (e.g., kayaking, indoor rock climbing, and community golf driving) might more positively change acute affective responses in the injured veterans than physical activity in a competitive setting (e.g., wheelchair basketball). The wheelchair basketball tournament provided highly competitive and hectic settings for the injured veterans. Each game consisted of four 10-min quarters, a 2-min break between quarters, and a 5-min halftime break. Two basketball courts were used simultaneously allowing four teams to compete at one time. These competitive and hectic settings might negatively impact acute affective responses in the injured veterans who experienced a loss after the first game.

In regard to the impact of exercise intensity and physical activity level on acute affective responses, active individuals who regularly participated in moderate-intensity physical activity experienced more PA and TR and experienced less NA and FA in comparison to sedentary individuals as reported in the previous literature (Carpenter et al., 2010; Ekkekakis and Petruzzello, 1999; Hogan et al., 2013; Magnan et al., 2013; Pittsinger et al., 2017). The injured veterans in the present study reported that they had regularly engaged in physical activity more than 150 min per week at a moderate intensity for the previous three months. The active injured veterans in both groups (i.e., winners and losers) demonstrated high positive affective feelings (i.e., PA and TR) and low negative affective feelings (i.e., NA and FA) at the start of the first game. However, the unpleasant affective experiences during competition (i.e., the experience of a loss) significantly reduced PA and increased NA in the losers. These results illuminate the negative impact that the experience of losing can have on one's acute affective responses. Due to the traumatic events of the military service, the injured veterans might be more vulnerable to a

negative game outcome during sport competition (i.e., after losing a game).

In order to optimize the benefits of a sport competition on acute affective experience in injured veterans, coaches and sport administrators should identify an ideal wheelchair basketball competition format. We should consider providing a longer rest time for injured veterans across four quarters in each game to regulate their feelings. We should consider hosting the competition in a recreational setting rather than in a competitive setting. In addition, we should guide injured veterans to adopt a mastery goal orientation (e.g., master one's sport skills) for sport competition rather than a strong performance goal orientation (Elliot et al., 2006; Yeatts et al., 2019). Coaches and team players should support injured veterans in recovering quickly from a setback, the experience of a loss in competition. More positive feedback and caring from coaches and team members need to be provided for injured veterans before, during, and after a sport competition to diminish the negative impact that the experience of losing has on their acute affective responses.

Due to the nature of the field-based (i.e., nonlaboratory) study, there are several limitations that we should consider. The first limitation of the study included a small number of injured veterans to test the hypothesis. Some veterans refused to complete consent forms due to their hectic competition schedule. Some veterans failed to complete the survey instrument. Another limitation is that the injured veterans for this study had multiple disabilities (PDs such as spinal cord injuries and amputation, PTSD, and a combination of PDs and PTSD). Indeed, it is difficult for the researchers to recruit a large number of homogeneous participants in a sport competition. In addition, the sport competition environment made it difficult for the researcher to follow a robust experimental design. Affective responses were only assessed in the injured veterans immediately at the start and at the end of the first game in the tournament.

Within the limitations of the present study, the results provide meaningful evidence explaining how sport game outcomes (i.e., winning or losing) influence acute affect responses in injured veterans. Within the same group, the injured veterans who experienced a loss in competition demonstrated a significant reduction in PA and a significant increase in NA. The injured veterans who experienced a win demonstrated a meaningful increase in PA and a meaningful decrease in NA as indicated by large to moderate effect sizes. In the group comparison, the injured veterans who experienced a win reported significantly higher PA at the end of the first game, while they experienced significantly lower NA com-

pared to the losers. The injured veterans who experienced a loss had more negative affective experience after the first game. In order to maximize the emotional benefits of sport competition, coaches should consider how to reduce the importance of winning in sport competition for injured veterans (e.g., valuable goal setting for wellness, sport skills improvement, or social connection). In addition, we should consider using a well-designed sport competition as a vehicle to emotionally rehabilitate injured veterans returning to the civilian life. Future researchers should consider using extensive sample, better control of the sport competition environment, and long-term assessments to support and generalize the meaningful findings of the present study.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported

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