# RELATIONS BETWEEN PSYCHOLOGICAL QUALITY AND TRAINING IN BASKETBALL PLAYERS

RELAÇÕES ENTRE A QUALIDADE PSICOLÓGICA E O TREINAMENTO EM JOGADORES DE BASQUETEBOL

RELACIONES ENTRE LA CALIDAD PSICOLÓGICA Y EL ENTRENAMIENTO EN JUGADORES DE BALONCESTO

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## ABSTRACT

Introduction: Psychological monitoring and psychological intervention of basketball players has been a focus of attention in sports training. In basketball, players consume much physical energy and also much mental energy. Psychological tension and emotional changes cause basketball players to restrict their technical abilities. Objective: Analyze the relationship between sport-induced mental fatigue and pre-game emotions in basketball players. Methods: This paper selects 40 basketball players as research volunteers. A survey questionnaire and mathematical statistics were used to analyze the relationship between basketball players' mental fatigue, training level, and pre-game emotions. This paper analyzes the relationship between psychological quality and training level of basketball players. Results: There were significant correlations between various dimensions of sport-induced mental fatigue and basketball players' pregame emotions. Basketball players' pre-game self-confidence is mainly affected by training game competence and excessive energy consumption. Conclusion: The psychological quality of basketball players is significantly correlated with the level of training. Athletes should pay attention to psychological quality training in sports competitions. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Mental Fatigue; Basketball; Athletes; Sports.

### RESUMO

Introdução: O acompanhamento psicológico e a intervenção psicológica dos jogadores de basquete tem sido foco de atenção no treinamento esportivo. No basquetebol, os jogadores consomem muita energia física e também muita energia mental. A tensão psicológica e as alterações emocionais fazem com que os jogadores de basquetebol restrinjam suas habilidades técnicas. Objetivo: Analisar a relação entre a fadiga mental induzida pelo esporte e as emoções pré-jogo nos jogadores de basquete. Métodos: Este trabalho seleciona 40 jogadores de basquetebol como voluntários de pesquisa. Utilizou-se um questionário de pesquisa e estatísticas matemáticas para analisar a relação entre a fadiga mental dos jogadores de basquetebol, o nível de treinamento e as emoções pré-jogo. Este trabalho analisa a relação entre a qualidade psicológica e o nível de treinamento dos jogadores de basquetebol. Resultados: Houve correlações significativas entre as várias dimensões da fadiga mental induzida pelo esporte e a emoção no pré-jogo dos jogadores de basquete. A autoconfiança dos jogadores de basquetebol antes do jogo é afetada principalmente pela competência dos jogos de treinamento e pelo consumo excessivo de energia. Conclusão: A qualidade psicológica dos jogadores de basquetebol está significativamente correlacionada com o nível de treinamento. Os atletas devem prestar atenção ao treinamento de qualidade psicológica nas competições esportivas. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Fadiga Mental; Basquetebol; Atletas; Esportes.

### RESUMEN

Introducción: El acompañamiento psicológico y la intervención psicológica de los jugadores de baloncesto han sido objeto de atención en el entrenamiento deportivo. En el baloncesto, los jugadores consumen mucha energía física y también mucha energía mental. La tensión psicológica y los cambios emocionales hacen que los jugadores de baloncesto limiten sus habilidades técnicas. Objetivo: Analizar la relación entre la fatiga mental inducida por el deporte y las emociones previas al partido en jugadores de baloncesto. Métodos: Este trabajo selecciona a 40 jugadores de baloncesto como voluntarios para la investigación. Para analizar la relación entre la fatiga mental de los jugadores de baloncesto, el nivel de entrenamiento y las emociones previas al partido se utilizó un cuestionario de encuesta y estadísticas matemáticas. Este artículo analiza la relación entre la calidad psicológica y el nivel de entrenamiento de los jugadores de baloncesto. Resultados: Hubo correlaciones significativas entre las diversas dimensiones de la fatiga mental inducida por el deporte y las emociones previas al partido de los jugadores de baloncesto. La autoconfianza de los jugadores de baloncesto antes del partido se ve afectada principalmente por la competencia del juego de entrenamiento y el consumo excesivo de energía. Conclusión: La calidad psicológica de los jugadores de baloncesto está significativamente correlacionada con el nivel de entrenamiento. Los deportistas deben prestar atención a la calidad psicológica del entrenamiento en las competiciones deportivas. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptores:** Fatiga Mental; Baloncesto; Atletas; Deportes.

## INTRODUCTION

Athletes' psychological monitoring and psychological intervention have increasingly become the focus of attention in sports training. At present, Chinese basketball still mainly focuses on improving athletes' physical fitness and skills. There is still a significant gap in the research on basketball players' individual and team psychology. Such a gap also provides a new opportunity for the research and application of sports psychology science in basketball.[1] Fatigue and its control are hot issues in the field of sports training. The source of physical fatigue of athletes is physical load, and the source of psychological fatigue is psychological load. Exercise-induced mental fatigue has its characteristics and measures.

## METHOD

### Research objects

This paper selects 40 basketball players as the research object. A total of 40 questionnaires were distributed during the research process of this study, and the recovery rate was 100%. The subjects engaged in basketball training for at least one year—to 14 years. The average training years is 5.09 years.

### Research tools

#### Measurement of exercise-induced mental fatigue

The Athlete's Psychological Fatigue Questionnaire (ABQ) has 15 items. It is divided into three dimensions: reduced sense of achievement, emotional/physical exhaustion, and negative exercise evaluation.[2] The internal consistency reliability coefficients of each subscale in this study were 0.617 for a decreased sense of achievement, 0.851 for emotional/physical exhaustion, and 0.712 for negative exercise evaluation.

#### Measurement of pre-match emotions

The Pre-Competition Emotion Scale-T (PES-T) scale has 16 items. It is divided into four dimensions: personal failure anxiety, self-confidence, social expectation anxiety, and somatic anxiety.[3] We use a 4-point Likert score. The internal consistency reliability coefficients of each subscale in this study were 0.847 for personal failure anxiety, 0.751 for self-confidence, 0.636 for social expectation anxiety, and 0.821 for physical anxiety. The reliability is ideal.

#### Affective computing model of interactive virtual human based on Markov decision process

Assuming that the emotional space contains n basic emotions, the emotional state-space set $E = \{e_i \mid i = 1,2,\cdots,n\}$ can be obtained.[4] We use the random variable $X$ to represent the affective state. Suppose $p_i$ is the probability of $X = e_i$ such that:

$$\sum_{i=1}^{l} p_i = 1, 0 \leq p_i \leq 1, (i \in [1,2,\cdots,n]) \tag{1}$$

In this way, the probability space model of emotional, mental state can be expressed as:

$$\begin{pmatrix} E \\ P \end{pmatrix} = \begin{pmatrix} e_1 & e_2 & \cdots & e_n \\ p_1 & p_2 & \cdots & p_n \end{pmatrix} \tag{2}$$

Each emotional state is further divided into $m$ intensity. but

$$e(i) = [e_i^1, e_i^2, \cdots, e_i^m], e_i^k \in [0,1], \sum e_i^k = 1 \tag{3}$$

We define $dis(e(i), e(j))$ as the distance between states $e(i)$ and $e(j)$, then

$$dis(e(i),e(j)) = \sqrt{(e_i^1 - e_j^2)^2 + \cdots + (e_i^m - e_j^m)^2} \tag{4}$$

Therefore, the similarity of emotions in space can be defined by the distance between different emotional states. Let $S_{ij}$ be the similarity between affective states $e_i$ and $e_j$, then

$$S_{ij} = 1 - 2dis(e(i),e(j))/n \tag{5}$$

When $e(j) = e(i)$, $S_{ij} = 1$ indicates that the degree of similarity between emotion and itself is 1. $S_{ij} = 0$ indicates that emotional states $e_i$ and $e_j$ are opposite emotions at this time, and they are in a diagonal position on the emotional circle. We then construct a probabilistic model of emotional change.[5] Such emotional space subdivides each emotional and psychological state into different intensities. And the degree of similarity between the positions of emotional state-space affects the probability of transition.

### Research methods

The scales used in this study were all distributed the day before the preliminaries and collected centrally. The influence of the game process and results on the mental state of the athletes can be avoided as much as possible.[6] The scales were filled out anonymously to ensure the authenticity of the athlete's answers. The obtained data were processed by SPSS 21.0.

There is no need for a code of ethics for this type of study.

## RESULTS

### The relationship between sports-induced mental fatigue and pre-game emotions in basketball players

#### Correlation analysis

We used multiple linear regression analysis to explore the predictive power of independent variables over dependent variables.[7] We first performed a Pearson correlation analysis on each dimension of the independent variable and dependent variable. In this way, the strength and direction of each dimension between the independent variable and the dependent variable can be determined. (Table 1)

It can be seen from Table 1 that there is a significant correlation between the various dimensions of sports-induced mental fatigue of basketball players and the various dimensions of pre-game emotion. All

**Table 1.** Correlation matrix between exercise-induced mental fatigue and pre-competition emotions.

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| A | 1 | | | | | | |
| B | 0.555 | | | | | | |
| | R2=.320 | 1 | | | | | |
| C | 0.307 | 0.585 | | | | | |
| | R2=.155 | R2=.333 | 1 | | | | |
| D | 0.373 | 0.355 | 0.303 | | | | |
| | R2=.223 | R2=.208 | R2=.153 | 1 | | | |
| E | -0.552 | -0.512 | -0.33 | -0.317 | | | |
| | R2=.305 | R2=.252 | R2=.115 | R2=.173 | 1 | | |
| F | 0.378 | 0.355 | 0.522 | 0.582 | -0.308 | | |
| | R2=.133 | R2=.217 | R2=.272 | R2=.355 | R2=.155 | 1 | |
| G | 0.592 | 0.535 | 0.317 | 0.713 | -0.507 | 0.598 | |
| | R2=.350 | R2=.303 | R2=.100 | R2=.508 | R2=.257 | R2=.358 | 1 |

dimensions of exercise-induced mental fatigue were negatively correlated with the self-confidence dimension of pre-competition emotions.[8] The rest are significant positive correlations. The degree of association for each dimension of the two variables was low to moderate. The results support the first set of hypotheses proposed in this study.

### Regression Analysis

In this study, the exercise-induced mental fatigue of basketball players was used as the independent variable, and the pre-game emotion was used as the dependent variable.[9] We employed stepwise multiple regression analysis to explore the predictive power of the independent variable over the dependent variable. We expect to build an optimal regression analysis model with this. Since the pre-match emotion of the dependent variable has four dimensions, the corresponding regression equation will have 4 (Table 2-Table 5).

The most predictor of the individual failure anxiety dimension was a decrease in achievement. Its explained variance amounted to 22.5%. Followed by negative sports evaluation.[10] The explained variance amounted to 5.5%. The overall test F value of the regression model was 15.983 ($P<0.05$). The two predictors could effectively explain 28.8% of the variation in individual failure anxiety, and both had positive effects. (Table 2)

The highest predictor of the confidence dimension was a decrease in achievement. Its explained variance is 30.6%. The second is emotional/physical exhaustion. The amount of variance explained was 6.8% (Table 3). The model's overall test F value was 22.240 ($P < 0.06$). The two predictors can effectively explain 36.3% of the variance in confidence, and both effects are adverse.

The highest predictive power of the social expectation anxiety dimension was negative exercise evaluation, which explained 27.3% of the variance. The second is emotional/physical exhaustion.[11] The explained variance was 3.9%. The overall test F value of the model was 27.672 ($P < 0.04$). The two predictors can effectively explain 32.2% of the variance of social expectation anxiety, which has positive effects.

**Table 2.** Stepwise multiple regression of individual failure anxiety on various dimensions of exercise-induced mental fatigue.

| Predictor variable | β | t | R2 | ΔR2 | F | ΔF |
|---|---|---|---|---|---|---|
| Decreased sense of achievement | 0.38 | 3.516 | 0.225 | 0.225 | 22.806 | 22.806 |
| Negative sports evaluation | 0.253 | 2.505 | 0.288 | 0.055 | 15.983 | 5.880 |

**Table 3.** Stepwise multiple regression of self-confidence on each dimension of exercise-induced fatigue.

| Predictor variable | β | t | R2 | ΔR2 | F | ΔF |
|---|---|---|---|---|---|---|
| Decreased sense of achievement | -0.386 | -3.622 | 0.306 | 0.306 | 34.626 | 34.626 |
| Emotional/physical exhaustion | -0.293 | -2.676 | 0.363 | 0.068 | 22.240 | 7.166 |

**Table 4.** Stepwise multiple regression of social expectation anxiety on various dimensions of exercise-induced fatigue.

| Predictor variable | β | t | R2 | ΔR2 | F | ΔF |
|---|---|---|---|---|---|---|
| Negative sports evaluation | 0.379 | 3.268 | 0.273 | 0.273 | 29.624 | 29.624 |
| Emotional/physical exhaustion | 0.244 | 2.207 | 0.322 | 0.039 | 27.672 | 4.440 |

**Table 5.** Stepwise multiple regression of physical anxiety on each dimension of exercise-induced mental fatigue.

| Predictor variable | β | t | R2 | ΔR2 | F | ΔF |
|---|---|---|---|---|---|---|
| Emotional/physical exhaustion | 0.441 | 4.452 | 0.403 | 0.403 | 53.255 | 53.255 |
| Decreased sense of achievement | 0.342 | 3.452 | 0.482 | 0.08 | 35.322 | 11.984 |

The highest predictor of physical anxiety was emotional/physical exhaustion, which explained 40.3% of the variance. This was followed by a decreased sense of achievement, explaining 8% of the variance (Table 5). The overall test F value of the model was 35.322 ($P<0.05$), and the two predictors could effectively explain 48.2% of the variance of somatic anxiety, and both had positive effects.

## DISCUSSION

This paper can significantly predict the factors of sports-induced mental fatigue in the individual failure anxiety dimension in basketball players' pre-game emotions.[12] We ranked them as decreased sense of achievement and negative evaluation of the exercise according to the magnitude of predictive power.

This paper can significantly predict that the factors of sports-induced mental fatigue in the self-confidence dimension of pre-competition emotions are decreased sense of achievement and emotional/physical exhaustion.[13] Confidence differs from the other three dimensions in the pre-game mood measurement. It measures primarily positive or positive emotions about the athlete before the game. The self-confidence of basketball players before the game is mainly affected by the two levels of competence in training games and excessive energy consumption. The higher the level of these two levels, the lower the self-confidence before the game.

This paper can significantly predict the social expectation anxiety in pre-competition emotional fatigue factors followed by negative sports evaluation and emotional/physical exhaustion.[14] Social expectation anxiety mainly refers to worry and anxiety about not being able to meet the expectations of others, such as teammates, parents, coaches, leaders, etc. The primary sources of social expectation anxiety are the decline of enthusiasm for training and competition and the emotional over-consumption of athletes.

This paper can significantly predict the physical anxiety in pre--competition emotional fatigue factors followed by emotional/physical exhaustion and decreased sense of achievement. Somatic focus is different from personal failure anxiety and social expectation anxiety. The measurement tendency is mainly related to some somatic symptoms of athletes before the competition and anxiety, such as heart rate, breathing, muscle, and other aspects of the response. The primary sources of physical anxiety in basketball players are emotions and reducing the sense of achievement.

## CONCLUSION

The unique charm of basketball is that it combines the softness of artistic performance with the vigor of sports. For a long time, this project's domestic research and development still only focused on some physiological, biochemical variables, and related indicators. Basketball players need to show absolute rationality, obedience, and other dehumanizing characteristics most of the time. Coaches and even athletes themselves do not have enough awareness and corresponding knowledge reserved for their psychological needs. Even if they are apparent, some typical psychological symptoms are attributed to common sense's level of physical symptoms. This makes the couch unable to prescribe the right medicine. The long-term appearance of psychological problems will harm the athletes' training and competition and even their physical and mental growth.

All authors declare no potential conflict of interest related to this article

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