


# Mental Training of Elite Athletes

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## Abstract

This study explores the concept of the optimal psychological state as a field of positive psychology. It aimed to demonstrate the influence of a mental preparation program to optimize mental state during competition. Statistic suggests that relaxation help athletes in controlling the cardiac frequency and, therefore, better control competitive anxiety. Results indicate that the placement of athletes in optimal conditions before the competition favors the appearance of an optimal psychological state. This research confirms that the study of optimal psychological conditions for performance stays an essential orientation for sports psychology.

## Keywords

Mental Preparation, Anxiety, Elite Athlete

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## 1. Introduction

Sports performance can easily be affected by controllable factors such as anxiety and uncontrollable factors such as the importance of competition's result. To perform well, an athlete must be able to adapt to the different situations which may occur during the competition (environment, advance or delay of his competition time, ...). He must also be able to manage various problems that could increase his level of anxiety. According to Brewer et al. (2019), high-level athletes increasingly use mental preparation (relaxation, imaging, ...) to optimize their performance. This permits development concentration and motivation, managing emotions, anxiety, stress, and value performance. It is possible to define mental preparation as a set of techniques that the athlete learns and then applies autonomously to develop his psychological qualities and optimize his performance. Psychological and mental preparation is presented as a cognitive, emotional, and behavioral strategy used to achieve a performance state or condition related to optimal psychological state and performance (Gould et al., 2009). An-

ticipating performance or competition can be a source of stress for an unprepared athlete. However, when athletes perceive competition anxiety as a challenge, they are more likely to maintain self-confidence and control their actions.

In sports psychology, many studies have explored emotional states as a determining condition of athletic performance (e.g., Michel et al., 2009; Castro-Sánchez et al., 2019). Researchers focus on negative emotions such as stress or anxiety in this context. Hence, the emergence of positive psychology as a new psychological current with a different orientation aims to study positive emotions such as joy, excellence, or optimal psychological state (Demontrond & Gaudreau, 2008). According to Houge Mackenzie & Brymer (2020), “This approach of well-being includes the effective management of unhelpful phenomena and supports positive achievements, emotions, relationships, commitment.”. As well, “optimal psychological state” is a concept that emerged from the current of positive psychology (Csikszentmihalyi, 2000; Jackson & Eklund, 2002), which took place alongside other concepts of general psychology and sports psychology later. This concept becomes very important because it focuses athletes’ attention on what is positive in each situation (Swann, 2016). It promotes the development of these positive elements, control, and use at critical moments in the athlete’s competition, which is a real challenge in realizing sports performances. Csikszentmihalyi (2000) defines “optimal psychological state” as an optimal state of activation in which the subject is wholly immersed in the activity. The main interest of positive psychology for the athlete is to focus on the elements that would make it possible to achieve athletic performance and not focus on the aspects that would disturb it, such as anxiety.

Several studies have demonstrated the effectiveness of the “optimal psychological state” in improving emotional and anxiety management during competition. We cite the Carter study (Carter et al., 2013), which states that “Challenge-skills refer to the need for individuals to have a balance between their current competitive situation and perceived skill level”. More, achieving this optimal psychological state requires several mental preparation techniques. Swann et al. (2012) state that psychophysiological approaches were the most technique used in other fields of psychology. However, it isn’t easy to practice this approach in the sports domain. Swann (2016) indicates that different sports specializations’ difficulty and complexity make collecting data very difficult. As a result, Mental preparator and specialist in sport psychology uses other methods that promote learning about “optimal psychological state”, which is, as Swann (2016) assert, (a) interviews; (b) questionnaires; and (c) the Experience Sampling Method.

In looking at the previous study of the “optimal psychological state” in sport, we chose the practice of shooting as a research paradigm. This activity seems appropriate to us at several levels. First, this approach corresponds to a reality experienced as shooters reported. We find that the experiences refer to the “optimal psychological state” of some of its dimensions, including concentration

and control. This research proposes to explore the use of the relaxation technique to help professional shooters control the different emotions generated by the competition, which can negatively influence the accuracy of the shoot. We've based our approach on the fact that shooters faced enormous pressure in competitions. This pressure is considered as an episode of competitive anxiety. This anxiety has a physiological aspect (somatic anxiety). Thus, physiological responses due to increased levels of anxiety manifest in increased cardiac frequency, which indicates a change in activation (Lu et al., 2010) that results in a fall in performance and poor control of the emotional state. And based on this, we thought that if the athlete learns to control their cardiac frequency regardless of the situation, they'll be able to control their anxiety and achieve sports performance. The use of relaxation techniques helps professional shooters control and reduce cardiac frequency and anxiety during the competition. Once this control is understood, the athlete can easily focus on his performance. In contrast to some previous studies (Swann, 2015; Swann et al., 2016, 2017), this research will not use the qualitative approach. The present study uses the "questionnaire approach" with a mental preparation program based on relaxation to highlight the effect of the Jacobson relaxation technique and cardiac coherence on controlling cardiac frequency, ameliorating anxiety level, and proving optimal psychological state. However, this approach, although different, will provide a new look at the actual measurement of the control of the "optimal psychological state". This study aimed to evaluate two hypotheses: 1) the relaxation technique associated with cardiac coherence can reduce the cardiac frequency and ameliorate the level of anxiety for the shooters during competitions, 2) the Jacobson relation technique can help shooters to optimize psychological state during sports competition.

## 2. Population Studied

Our study population consists of nine (9) elite volunteer shooters (05 men, 04 women). Participants were aged from 21 - 31 years. Means  $\pm$  SD age was (27.75  $\pm$  3.06). These athletes regularly participate in national and international shooters competition. Shooters train 12 sessions a week, six days, for two sessions by day.

## 3. Procedure

A single athlete group was formed and was subjected to twenty-four mental training sessions, with an average duration of thirty minutes spread out 12 weeks, with two sessions per week. These mental preparation sessions use Jacobson's progressive relaxation technique and the cardiac coherence technique. As far as heart-consistency exercises are concerned, the athlete must repeat them three times daily. Athletes responded to the anxiety questionnaire and the optimal psychological state scale. Cardiac frequency was recorded with cardio meters in two stages (at the beginning of the intervention and the end).

#### 4. Mental Training Program

The content of this program was inspired by the work of Parnabas et al. (2014). This program includes two techniques: Jacobson's relaxation and cardiac coherence. The sessions were planned as follows: the first four sessions concern breathing, relaxation techniques, and cardiac coherence. For the twenty last sessions, athletes should perfect their relaxation technique. This session consists of three parts: a first "rest" of 5 to 10 minutes. The shooter starts by tensioning a limb, for example. "Stick the forearm into the arm". While maintaining this tension, the athlete is asked to feel the contracted muscles. The second part concerns the 20 min "activation", where the shooter ceases the effort and is asked to handle this new sensation of muscle release. Thus, progress is made throughout the whole body from session to session until a comprehensive control (general relaxation) is obtained. The muscle groups sought are upper limbs (right and left), starting with the hand and reaching the arms and lower limbs (beginning with the foot and reaching the knee), the trunk, and the face. The third step is on the practice of heart coherence: Sitting on a chair with their vertical back, shooters observe a ball's movement on the screen of their laptops. Their breathing follows the object's motion.

#### 5. Scales and Material

For this research, two evaluations were conducted, pre-test ( $t_0$ ) and a re-t ( $t_1$ ), to study the effect of using relaxation techniques on reducing the cardiac frequency and optimizing the psychological state condition of the shooters. To do this, we used the following questionnaire and material:

- **CSAI-2-Tn questionnaire:** Hajji & Elloumi (2017), we use the Arabic version of the Competitive State Anxiety Inventory-2. This scale measures the state of anxiety when they are confronted with sports competitions. The CSAI-2-Tn consists of 23 items measuring the following three components: self-confidence, somatic, and cognitive anxiety. A specific total for each subscale determines the individual score in rounds.
- **Optimal psychological state scale:** (Heutte et al., 2016) contain 12 items based on a 7-item Likert scale from 1 to 7. The shooter must choose the number most appropriate to his opinion. This questionnaire is four-dimensional: D1: cognitive absorption; D2: time transformation; D3: ego expansion; D4: well-being.
- **Cardio-frequency meter:** It is used to record the cardiac frequency of shooters during competition.

#### 6. Data Analysis

Pre- and post-intervention scores for cardiac frequency, anxiety, and optimal psychological state scale were analyzed using comparative analysis based on the Wilcoxon T-test to account for potential differences before and after using the relaxation method for 12 weeks. We considerate relaxation technique as the independent variable in this study. Therefore, dependent variables are anxiety,

cardiac frequency, and four dimensions optimal psychological state. Descriptive statistics (Average/Standard deviation) were maintained for dependent variables. Also, a Person Correlation Test was used to assess possible relation between the optimal psychological state, anxiety and cardiac frequency. A level of meaning of 0.05 is used for all statistical analyzes maintained.

#### 7-Result:

**Table 1** demonstrates the cardiac frequency and anxiety change between ( $t_0$ ) and ( $t_1$ ). The Wilcoxon test presented cardiac frequency and anxiety as dependent variables. A significant effect of relaxation exercises for cardiac frequency was found ( $P$  minimum = .01 > .1;  $P$  maximum = .00 > .01;  $P$  average = .00 > .01). the Wilcoxon test shows that participants cardiac frequency decreased during the 12 weeks of mental preparation. Moreover, the level of cognitive anxiety and self-confidence did not differ between ( $t_0$ ) and ( $t_1$ ). Results did not show a significant difference between the average of these two variables scores in ( $t_0$ ) and ( $t_1$ ). Concerning somatic anxiety, a significant difference was found between the participant score in ( $t_0$ ) and ( $t_1$ ) ( $P = .04 > .05$ ), which indicate an amelioration in somatic anxiety level.

The analysis present in **Table 2** listed the descriptive statistic (means and standard deviation) of the four dimensions of optimal psychological state scale.

**Table 1.** Comparatives Statistic between  $t_0$  and  $t_1$  for cardiac frequency and anxiety.

Test	Variables	Pre-test ( $t_0$ )		Post-test ( $t_1$ )		Sig.
		M	ST	M	ST	
Cardiac frequency	Minimum	85.23	9.65	73.82	11.89	.01**
	Maximum	112.15	13.29	98.48	13.64	.00**
	Average	137.85	16.53	122	14.81	.00**
CSAI-2-tn	Self-confidence	25.42	3.42	30.41	3.87	.38
	Cognitive anxiety	17.85	4.82	14.27	5.77	.46
	somatic anxiety	18.97	4.65	16.49	4.27	.04*

Note: \*Significant difference (.05), \*\*Highly significant differences (.01).

**Table 2.** Comparatives Statistic between  $t_0$  and  $t_1$  for optimal psychological state scale subscale.

Test	Variables	Pre-test ( $t_0$ )		Post-test ( $t_1$ )		Sig.
		M	ST	M	ST	
Optimal psychological state	D1	16.82	3.22	15.22	4.33	.60
	D2	9.48	4.54	12.53	3.15	.42
	D3	6.87	3.38	10.88	4.28	.01**
	D4	12.63	2.57	14.87	3.77	.04**

Note: \*Significant difference (.05), \*\*Highly significant differences (.01).

**Table 2** shows that post-intervention scores for D3 (ego expansion) and D4 (well-being) were significantly higher than the pre-intervention ( $P\text{-D3} = .01$ ;  $P\text{-D4} = .04 < .05$ ). However, the results revealed a lower means for D1 (cognitive absorption) and D2 (time transformation) in  $t_1$  compared to  $t_0$ ; this indicates no significant difference for these two subscales.

**Table 3** shows the relation between cardiac frequency, anxiety, and different level of optimal psychological state, based on Pearson's correlation coefficient. The 4<sup>th</sup> dimension (D4, well-being) was negatively associated with participants' minimum cardiac frequency. D4 was also positively associated with the maximum and overage cardiac frequency. Among the other dimensions of optimal psychological state, D3 (ego expansion) was significantly related to somatic anxiety ( $-.618$ ). This result means that when anxiety decreased, the optimal psychological state increased.

However, D1, D2, and D4 did not directly associate cognitive and somatic anxiety. In contrast to D4, the optimal psychological state dimensions D1, D2, and D3 were not related to cardiac frequency.

## 7. Discussions

This study aimed to test the effect of relaxation techniques on optimizing psychological conditions by reducing the cardiac frequency rate of the shooters. During a competition, shooters, like any athlete, can feel technically and physically ready and yet completely miss the event. It's evidence that the mental and emotional components can take over purely physical and technical aspects of performance. Therefore, mental training appears to be a devoted component of athletic performance and technical, tactical, or physical exercise. In addition, shooting involves, in the final phase of the competition, a period of immobilization during which all the powers of the shooter are exacerbated.

**Table 3.** Relation between anxiety, optimal psychological state, and cardiac frequency.

Variables	Somatic anxiety	Self-confidence	D1	D2	D3	D4	Min frequency	Max frequency	Medium frequency
Cognitive anxiety	.65*	-.39	-.18	-.05	-.40	.00	.36	.23	.10
Somatic anxiety	1	-.38	-.06	.00	-.618*	.21	-.03	.02	-.07
Self-confidence		1	.39	.04	-.16	.41	-.22	-.25	-.27
D1			1	.82*	.05	.71*	-.30	-.03	.07
D2				1	-.78*	.30	-.27	-.34	-.33
D3					1	-.62*	-.22	-.25	-.09
D4						1	-.56*	-.53	-.49
Min frequency							1	.87*	.79*
Max frequency								1	.95**

Note: \*Significant difference (.05), \*\*Highly significant differences (.01).

The first hypothesis of this work concerns the effectiveness of relaxation techniques in reducing the cardiac frequency of shooters and the anxiety level. This hypothesis states that the relaxation technique associated with cardiac coherence can reduce the cardiac frequency of the shooters during competitions. The results obtained showed a highly significant difference in all parameters of cardiac frequency rate evaluated in the shooters. This result indicates a very significant improvement in the mean of the scores at the minimum, average and maximum cardiac frequency between the pre-test and post-test, which confirms the work of Pelka et al. (2016), describing relaxation as a state marked by a decrease in the alert level of cardiac and respiratory frequency. The result is a feeling of relaxation and well-being. It's an ordinary and necessary physiological phenomenon that takes the body back to its normal metabolism after a considerable effort or a stressful time. Consequently, anxiety, especially somatic anxiety, decreased significantly between  $t_0$  and  $t_1$ . This observation indicates amelioration of the control of competitive anxiety.

Hypothesis 2 states that relaxation allows optimization of the optimal psychological state of the shooters. Statistical comparison between the pre-test and post-test found a significant difference in dimension 3 (ego expansion). Results also show non-significant differences for the three other dimensions of optimal psychological state, even though the averages of the scores of  $t_1$  are higher than those of  $t_0$ , indicating that relaxation does not affect the optimization of the optimal psychological state. In addition to the statistical data collected, the statements of the shooters revealed two different sensations, some of which state that relaxation provides a state of well-being and self-confidence. In contrast, others admit that relaxation has no effect during the competition; this can be explained by the work of Csikszentmihalyi (2000), who considers that optimal psychological experience has significant consequences: better performance, creativity, capacity building, self-esteem, and stress reduction. A set of other studies (Delle Fave, Massimini, & Bassi, 2011) provide consistent results and show the importance of different concepts in the optimal psychological experience, such as positive links with motivation and negative relations with anxiety or stress.

Thus, the correlation between anxiety and optimal psychological state confirms the studies of (Delle Fave, Massimini, & Bassi, 2011), which states that there is a negative link between the two variables. In its original theorization (Csikszentmihalyi, 2000), the optimal experience is an appropriate correspondence between challenge and individual abilities. The optimal experience allows the athlete to forget the negative emotion, stress, and anxiety. The nature of the optimal psychological experience requires a total concentration of attention on the current task. Averages in the scores of competitive anxiety dimensions between the pre-test and post-test were observed to control changes. Still, this evolution concerned somatic anxiety, but in the state of cognitive anxiety and confidence, there was a non-significant difference. Athletes confirm this result and indicate that they have a relaxed body and do not have balls in their sto-

machs as usual. Swann (2016) explained that relaxation session causes a reduction of psychological tension and decrease anxiety if the subject is anxious.

Finally, this study has demonstrated the positive effect of relaxation on the reduction of cardiac frequency resulting in an improvement in the somatic anxiety state of elite athletes. This improvement allows better management of the optimal psychological state resulting in more excellent performance stability.

## 8. Conclusion and Recommendations

Under pressure, athletes try to control their actions too much and have a perfect performance. This control increases the risk of errors and slows down execution. The optimal psychological state appears to be optimal for athletes to promote high performance. In addition, mental preparation can improve the control of specific muscle contractions, which are indispensable for realizing a technical gesture and relaxing non-essential muscles. Based on the results obtained from this study and our findings, we recommend that coaches integrate relaxation into training programs to reduce the cardiac frequency and somatic anxiety, thereby increasing the optimal psychological condition of shooters.

## 9. Search Limits

This study tested the effect of relaxation on cardiac frequency reduction, improved anxiety management, and optimal psychological state. Nevertheless, other research, particularly methodological ones, can complete this work. However, this study could have better results if we could manage with specific limitations: 1) The coach should encourage mental preparation, especially relaxation techniques, to have better results. 2) The period reserved for mental preparation is concise; it should be along the sport's season. 3) Other studies can explore other methods of development of the optimal psychological state.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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