

"Utilizing Relaxation Techniques in Sport Psychology to Enhance Emotional Regulation and Athletic Performance"

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Abstract: This research examined the effect of a relaxation program on the anxiety-state of sprinters before two competitions, without finding any significant effect. Although the experimental group showed a slight decrease in state-anxiety, this difference was not statistically significant. The results diverge from the literature, which highlights the effectiveness of relaxation in reducing stress and improving performance (Cox, 2013; Weinberg & Gould, 2019). This discrepancy could be explained by insufficient intervention duration, too small a sample size or athletes' prior experience in stress management. In addition, the measurement tools used did not take into account all the dimensions of anxiety, limiting the analysis. These observations suggest that interventions should be extended, samples broadened and more comprehensive methodologies adopted in future research.

Key words: Sport Psychology, Anxiety-State, Relaxation, Performance,

1. INTRODUCTION

This study demonstrates that, despite certain methodological limitations, the use of relaxation techniques can improve sprinters' ability to control their emotional state prior to competition. Our results could encourage coaches and mental trainers to integrate relaxation sessions into mental training programs to reap its benefits.

The experiments set up in this study failed to validate the hypothesis proposed at the start of this study that "relaxation can reduce levels of state anxiety in sprinters approaching competition". Nevertheless, it is important to note that further research, involving larger samples and longer duration relaxation exercises, is required to obtain results consistent with the literature.

One of the techniques most commonly used to control the anxiety threshold of athletes in general and pre-competition athletes in particular.

1.1 Issues

Athletes need to harness their mental strength to reach their full athletic potential. The stress, performance pressure and tension inherent in a competitive environment can all have an impact on physical performance.

To achieve the best sporting performance, sprinters need to combine the four performance parameters of body, technology, tactics and psychology. They cannot focus solely on body, technology and tactics and ignore psychological preparation.

This behavior is very evident in the training program of most Moroccan athletes. This creates a problem for them on match day, as they are unable to control their emotions even if they are perfectly prepared in advance.

In this case, it's fun to be mentally prepared. For example, by using simple breathing and relaxation techniques before a competition, athletes with higher-than-normal levels of emotional distress and anxiety can easily control themselves and avoid anxiety. Implementing these routines in athletes leads us to ask questions about the role mental preparation plays in an athlete's preparation. Does relaxation help to reduce sprinters' anxiety levels in the run-up to a race?

1.2 Research interests

Through this work, we hope to raise awareness among coaches and athletes of the importance of mental preparation in relation to other sports preparation, and the importance of using relaxation techniques to manage emotions, particularly anxiety levels. The competition is approaching.

2. THEORETICAL FRAMEWORK

CHAPTER 1

1.1 Anxiety in athletes

Anxiety in athletes has been extensively studied in the scientific literature. It represents a complex psychological phenomenon that can influence sports performance, athletes' well-being and their mental preparation. Here is a detailed analysis based on major contributions by authors in the field.

1.1.1 Concept of anxiety in sport

Anxiety can be defined as a negative emotional response associated with feelings of nervousness, apprehension and tension, often linked to performance expectations or fear of failure (Weinberg & Gould, 2014). In sport, it generally manifests itself in two forms:

- State anxiety: a temporary emotional response to a specific situation.
- Trait anxiety: a stable tendency to perceive situations as threatening, leading to frequent anxious responses.

1.1.2 Sources of anxiety in athletes

According to Martens et al (1990), the main sources of anxiety in sport include:

- Performance pressure: The desire to perform well and avoid failure can increase anxiety, especially before a competition.
- Expectations of coaches and teammates.
- External factors: audience, environmental conditions, level of competition.
- Self-perception: Negative self-perception or a low level of confidence.

1.1.3 Dimensions of competitive anxiety

Martens (1977) proposed a model of competitive anxiety based on three main components:

- Cognitive anxiety: negative thoughts, fear of failure and mental ruminations.
- Somatic anxiety: physiological symptoms such as accelerated heart rate, sweating and muscle tension.
- Self-confidence: Considered a moderating factor, high self-confidence can reduce the negative impacts of cognitive and somatic anxiety.

1.2 Theoretical models of anxiety in sport

1.2.1 Multidimensional theory of competitive anxiety (Martens et al., 1990)

This model distinguishes between cognitive and somatic anxiety, suggesting that these two types of anxiety influence performance differently:

- An increase in cognitive anxiety is associated with a decrease in performance.
- Somatic anxiety follows an inverted U-shaped curve: moderate levels improve performance, but very low or very high levels can worsen it.

1.2.2 Optimal operating zone theory (Hanin, 1997)

Hanin proposes that every athlete has an "optimal anxiety zone" that maximizes performance. Unlike general theories, this approach emphasizes the individuality of emotional responses and the importance of personalizing psychological interventions.

1.2.3 Inversion theory (Apter, 1982)

This theory suggests that an athlete's perception of his or her emotional state can modify the effect of anxiety. For example, some athletes may interpret physiological arousal as a source of motivation, while others perceive it as a threat.

1.3 Impact of anxiety on sports performance

1.3.1 Negative effects

- Concentration degradation : Cognitive anxiety can interfere with attentional processes, making rapid decision-making difficult (Eysenck et al., 2007).

- Impaired motor skills :
Somatic anxiety can lead to muscular rigidity and technical errors.

1.3.2 Positive effects

A certain level of anxiety can have beneficial effects, such as physiological and mental activation, thus improving preparation for exercise (Jones, 1995). This depends on the athlete's ability to interpret this anxiety in a positive way (notion of facilitating anxiety).

1.4 Anxiety management strategies for athletes

Several authors have proposed interventions to reduce or manage anxiety in athletes:

1.4.1 Relaxation techniques (Jacobson, 1938) :

- Progressive muscle relaxation.
- Breathing control.

1.4.2 Mental imagery training (Holmes & Collins, 2001):

- Visualize successful performances to boost confidence.

1.4.3 Reducing negative thoughts:

- Cognitive techniques to replace limiting beliefs with positive affirmations (Beck, 1976).

1.4.4 Mindfulness and mindfulness :

- According to Gardner and Moore (2007), mindfulness can help athletes accept their sensations and thoughts without judgment, thus reducing the impact of anxiety.

1.4.5 Individualized approach :

- Identification of each athlete's zone of optimal functioning (Hanin, 1997).

1.5 Individual differences and moderating factors

1.5.1 Type

Studies show that women tend to report higher levels of competitive anxiety than men (Jones et al., 1994). This may be due to biological or social differences in the way emotions are managed.

1.5.2 Type of sport

- Individual sports are associated with higher anxiety, as responsibilities rest solely with the athlete (Scanlan et al., 1989).
- In team sports, the support of teammates can act as a protective factor.

1.5.3 Experience and level of competition

Experienced athletes generally show better anxiety management thanks to housing and strategies developed over time (Hardy et al., 1996).

1.6 The relationship between anxiety and performance in athletes

Anxiety and sports performance have a complex relationship. Various authors have examined how anxiety influences performance, whether positively or negatively, using a variety of theoretical frameworks and empirical methodologies.

1.6.1 The nature of anxiety in sport.

Anxiety in sport is an emotional state characterized by feelings of tension, apprehension and physiological responses (Weinberg & Gould, 2014). It is often divided into two main components:

- Cognitive anxiety: linked to negative thoughts and worries.
- Somatic anxiety: linked to physiological symptoms such as increased heart rate.

1.6.2 Theories explaining the relationship between anxiety and performance

Inverted U-curve theory (Yerkes & Dodson, 1908): This theory suggests that a moderate level of activation (or somatic anxiety) enhances performance, but that levels that are too low or too high impair performance. The relationship is thus represented as an inverted U-shaped curve. However, this theory does not take into account the cognitive dimensions of anxiety.

Multidimensional theory of anxiety (Martens et al., 1990): Martens proposed that :

- An increase in cognitive anxiety is always negative for performance.
- Moderate somatic anxiety can be beneficial, but very high or very low levels have detrimental effects.

- Optimal functioning zone theory (Hanin, 1997): Hanin introduced the idea that every athlete has an "optimal anxiety zone" where he or she can maximize performance. This individualized model suggests that the effects of anxiety vary according to the athlete's personal characteristics.

-Catastrophe model (Hardy, 1996): This model integrates the cognitive and somatic dimensions. It suggests that when an athlete experiences high cognitive anxiety, a slight increase in somatic anxiety can lead to a drastic drop in performance, creating a "catastrophe".

-Facilitative and deleterious anxiety model (Jones, 1995): Jones proposed that the subjective interpretation of anxiety is crucial:

- If anxiety is perceived as a source of motivation, it can improve performance.
- If it is perceived as a threat, it has a deleterious effect.

1.6.3 Empirical studies on the relationship between anxiety and performance

-Cognitive anxiety and performance: Studies show that cognitive anxiety, which includes negative thoughts and worries, is generally negatively correlated with performance. For example, Craft et al (2003), in a meta-analysis, found that cognitive anxiety has an adverse effect on sports performance.

Somatic anxiety and performance: Somatic anxiety has a complex, context-dependent relationship with performance. Research by Martens et al (1990) shows that the effects of somatic anxiety often follow an inverted-U curve.

-Optimal functioning zone: Woodman and Hardy (2001) have shown that athletes who manage to stay in their optimal anxiety zone, as defined by individualized psychological assessments, perform better than those who leave it.

1.6.4 Moderators of the relationship between anxiety and performance

-Type of sport: Athletes in individual sports (swimming, tennis) are often more affected by

anxiety, as they bear sole responsibility for their results (Scanlan et al., 1989).

In team sports, teammates provide social support, often alleviating anxiety.

-Competition level: Experienced athletes manage their anxiety better than novices (Hardy et al., 1996), as they develop strategies for coping with stressful situations.

-Gender: Jones et al (1994) found that women often report higher levels of anxiety than men, which may influence their performance differently.

1.6.5 Interventions to manage anxiety and improve performance

-Relaxation techniques :
Progressive muscle relaxation (Jacobson, 1938).

Controlled breathing techniques.

-Mental imagery training: Holmes and Collins (2001) have shown that visualizing successful performance reduces cognitive anxiety.

-Mindfulness: Gardner and Moore (2007) suggest that the practice of mindfulness helps athletes focus on the present moment, reducing the negative effects of anxiety.

-Cognitive behavioral interventions :
Beck (1976) has shown that replacing negative thoughts with positive affirmations can reduce cognitive anxiety.

Chapter 2

2.1 Sport psychology

2.2 The inverted-U theory

The inverted-U theory (Yerkes & Dodson, 1908) is one of the most influential models to explain the relationship between activation (arousal) and performance. It proposes that sports performance is optimal at a moderate level of activation. When activation levels are too low or too high, performance declines.

2.2.1 Origin of the theory

The theory was first proposed by Yerkes and Dodson (1908)** from an experiment on mice, where they observed that performance in learning a task depended on the intensity of arousal. They found that a moderate level of arousal favored optimal performance, while very low or very high levels reduced it.

2.2.2 Application to sports

Inverted-U curve: The relationship between activation and performance is graphically represented by an inverted-U curve.

Low level of activation: The athlete is under-stimulated, which can lead to loss of concentration, lack of motivation and poor performance.

Moderate level of activation: The athlete reaches a state of optimal activation, where concentration, motivation and motor skills are maximized.

High level of activation: Excessive excitement can lead to anxiety, loss of concentration and technical errors, all of which impair performance.

2.2.3 Factors influencing the curve

- Task type: Simple or automatic tasks (e.g. repetitive actions) can tolerate a higher level of activation.

Complex tasks or those requiring fine precision (e.g. archery) generally require a lower level of activation.

- Individual characteristics: Each athlete has a unique optimal activation level depending on his or her personality (introvert/extravert) and experience. For example:

Extraverts often need a higher level of activation to reach their peak performance.

Introverts, on the other hand, prefer lower levels of activation.

2.2.4 Criticism of the theory

-Lack of individualization: The theory does not take into account individual variations in response to activation. Not all athletes follow the same curve.

-Lack of distinction between types of anxiety: The theory does not differentiate between the cognitive (negative thoughts) and somatic (physical symptoms) components of anxiety, which is addressed in later models such as the multidimensional theory of anxiety (Martens et al., 1990).

Non-linear dynamics: Hardy (1996), in his catastrophe model, criticized the simplicity of the inverted-U curve, arguing that the relationship between activation and performance is more complex and can include sudden drops in performance under certain conditions.

2.2.5 Empirical studies on the inverted U theory

-Studies supporting the theory: Weinberg and Gould (2014) summarized several research

studies confirming that moderate levels of activation improve sports performance, particularly in team sports such as basketball or soccer.

-Critical studies: Hanin (1997), with his theory of optimal functioning zones (IZOF), has pointed out that the inverted U theory is too generalized. His research shows that every athlete has a unique zone of optimal activation, which is not necessarily symmetrical or located in the middle of the curve.

2.2.6 Practical applications in sports

-Coaches and sports psychologists use the inverted U theory to :

Identify the optimal activation level for each athlete.

Adapting anxiety management strategies :

Relaxation techniques to reduce excessive activation.

Mental or physical stimulation to increase insufficient activation.

Train athletes to recognize their physiological and cognitive activation signals.

2.3 Relaxation strategies and emotion management in sport psychology

The management of emotions and the use of relaxation techniques occupy a central place in sports psychology. These strategies aim to improve athletes' performance by reducing stress and optimizing their mental and physical well-being.

2.3.1 The importance of managing emotions in sport

Emotions have a direct influence on an athlete's performance. Negative emotions such as

anxiety or fear can impair concentration, alter motor skills and reduce the effectiveness of decision-making (Hanin, 1997). Conversely, positive emotions such as self-confidence and excitement can enhance performance (Jones, 1995).

-Defining emotions in sport :

Positive emotions: confidence, pride, joy.

Negative emotions: anxiety, anger, frustration.

Emotions can be triggered by internal factors (thoughts, beliefs) or external factors (audience, opponents).

2.3.2 Relaxation strategies in sport psychology

Relaxation techniques aim to reduce stress levels and help athletes achieve an optimal mental state.

a. Progressive muscle relaxation (Jacobson, 1938):

This technique involves progressively contracting and releasing the body's muscle groups to reduce physical and mental tension.

Objective: Reduce the physiological symptoms of anxiety (rapid heartbeat, muscle tension).

Effectiveness: Particularly useful before competitions for sports requiring precision (archery, golf).

b. Breathing control

Breath control is a simple way to reduce stress and improve concentration.

- Common techniques :

- Deep diaphragmatic breathing.

- Square breathing (inspiration, retention, expiration, retention).

- Benefits: Slows heart rate and induces a state of calm.

c. Autogenic training (Schultz, 1932)

Autogenic training is based on mental and physical exercises designed to induce a state of deep relaxation through auto-suggestion (e.g. "my arms are heavy").

- Benefits: Suitable for athletes who want to reduce stress without relying on an external practitioner.

d. Mental imagery and positive visualization

- Description: Athletes visualize positive scenarios, such as a successful performance or a calm environment.

- Effectiveness: Holmes and Collins (2001) have shown that this technique reduces cognitive anxiety and improves confidence.

e. Managing emotions in sport psychology

-Identifying and regulating emotions

Cognitive assessment: Athletes learn to recognize emotional triggers (e.g. fear of failure) so they can manage them better.

Cognitive reframing strategies: Changing negative thoughts to positive beliefs (Beck, 1976).

-Mindfulness: Mindfulness is about focusing on the present moment without judgment.

Advantages :

Reduces anxiety and improves decision-making (Gardner & Moore, 2007).

Enables athletes to better tolerate uncomfortable emotions, such as pre-competitive stress.

Emotional self-regulation techniques

Behavioral approaches :

Controlled exposure to stressful situations to increase emotional tolerance.

Cognitive approaches :

Use of positive self-instructions to improve concentration and reduce anxious thoughts.

-Optimal functioning zone theory (Hanin, 1997): Hanin suggests that every athlete has an optimal emotional zone (positive or negative) that promotes performance. The aim is to keep athletes in their zone by adjusting their emotional responses.

f. Integrated emotion management techniques

-Pre-competitive routines: Structured routines, such as listening to music or following specific exercises, help maintain a stable emotional state.

-Biofeedback: Biofeedback monitors physiological signals (heart rate, muscle tension) and teaches athletes how to control them.

Effectiveness: Improves body awareness and reduces somatic anxiety.

Social support: Support from coaches, teammates and family members can alleviate negative emotions, especially during major competitions (Scanlan et al., 1991).

g. Practical examples in various sports

-Precision sports (shooting, golf): Increased use of progressive muscle relaxation and visualization to reduce physical and mental tension.

Team sports (soccer, basketball): Focus on team routines and social support to reduce performance-related pressure.

-Individual sports (swimming, tennis): Individualized approaches, such as mindfulness and breathing exercises.

3. METHODOLOGY

3.1 Topics

In the specific case of our study, the sample was made up of male and female national team athletes in the senior age category and sprint discipline. They were divided into two groups: 6 experimental subjects and 6 control subjects.

3.2 The data collection instrument

Following an experimental protocol to measure state anxiety in athletes on two occasions, before and after using the relaxation method, we used Spielberger's validated S.C.A.T (State-Trait Anxiety Inventory) questionnaire (Charles Donald Spielberger, 1927) as a tool to measure anxiety levels. Spielberger was a clinical psychologist well known for his development of this tool.

3.3 Introducing the SCAT test

The S.C.A.T. questionnaire is composed of two scales: an Anxiety-State scale, which assesses the feelings of apprehension, tension, nervousness and worry that the subject experiences at the time of the anxiety-provoking situation or competitive situation. And an Anxiety-Trait scale, which assesses the level of anxiety in general life, the latter being a stable personality disposition.

This test enables you to assess your anxiety level over the past few weeks. If you take it again in a few months' time, it will probably be different: worse if life has brought you more worries, or better if there have been fewer and/or if your personal development efforts are bearing fruit.

This test only gives a point estimate. For athletes, competition can be an anxiety-provoking situation. This scale can therefore measure the anxiety experienced by the subject in a competitive situation.

3.4 Questionnaire administration

The questionnaire comprises two scales of 20 items each, designed to assess trait and state anxiety. In this research, state-anxiety was assessed using the State-Trait Anxiety Inventory (STAI) in its Y form, developed by Spielberger (1969) and published in its final form in 1983, in the French version by Bruchon-Schweitzer and Paulhan (1993). Each item is rated according to its intensity on a 4-point Likert-type scale ranging from 1 = almost never to 4 = almost always.

The [Form Y] was developed to eliminate items related to depression, and therefore measures only the psychological dimension of the anxiety experience (physiological component omitted). The State-Trait Anxiety Scale thus distinguishes between the normal population and those suffering from a high level of anxiety.

STAI-Y is designed for self-administration. It takes around 5 minutes to complete. It can be completed alone or in a group. The STAI-Y is highly sensitive to change and can therefore be used to monitor changes in anxiety levels at different times.

3.5 Interpreting questionnaire scores

When you obtain a completed questionnaire, simply count questions 3, 4, 6, 7, 9, 12, 13, 14, 17 and 18:

1 point for the answer 'Not at all'.

2 points for the answer 'A little',

3 points for 'Moderately'.

4 points for the answer 'A lot'.

For questions 1, 2, 5, 8, 10, 11, 15, 16, 19, 20, the scoring is reversed, i.e. count :

4 points for 'Not at all

3 points for 'A little'.

2 points for 'Moderate

1 point for 'A lot'.

Then add up your points.

The average for women is 42, and for men 37.

If the score is above this average, the competitive situation generates significant anxiety. The higher the score, the more anxiety the competition generates.

> In men, if the score exceeds 48, anxiety interferes with competitive performance.

> In women, if the score exceeds 55, anxiety interferes with sports performance.¹

3.6 Experimental protocol

Two groups of balanced performance levels were formed for the experiment: a Control group and an Experimental group. The experiment was carried out over a period of approximately one month between two

Casablanca league competitions of the same stakes, corresponding to the two experimental tests (Test 1 & Test 2). During these two tests, on the eve of the competition, we measured the level of anxiety in both groups after a training session.

3.7 Relaxation protocol :

For the relaxation method we used the **Jacobson method**:

Jacobson's method is considered to be the first scientific method of relaxation.

It consists of systematic, progressive muscle-relaxation training for every part of the body.

This is done by contracting a muscle group for a few seconds and then releasing the tension completely.

The Jacobson method has been both studied and used as a relaxation method and a therapy in its own right.

Progressive muscle relaxation has also been integrated into cognitive behavioral therapies.

For example, it is a major component of the systematic desensitization method.

This work was done after intense sessions. So that the athletes could relax.

3.8 Statistical tests :

To compare the state anxiety levels of the athletes in the two tests, we used the Student's T-test. This test is used to determine whether there is a significant difference between the means of two groups or the means of the same group in two different situations. It is based on a comparison of the means of the two groups, as well as the variability within each group. The formula for Student's t-test is as follows:

$$T = \frac{\text{Difference in group averages}}{\text{Group variability}}$$

In this study we will compare the results of the two-group SCAT test in the two tests (1 & 2), as well as the results of the same group (Experimental & Control) between the two tests (1 & 2).

The result of the t-test is a score that measures the difference between the means of the two groups, adjusted for variability within each group. This t-score is then compared to a critical value to determine whether the observed difference between the means is statistically significant.

The interpretation of the student test depends on the score obtained and the associated degree of freedom. By comparing the t-score with a critical value in a table of t-values, or by using statistical software, you can determine whether the observed difference is statistically significant.

4. RESULTS

4.1 Results of athletes in the experimental group in both tests

Table 1 Anxiety-status results for athletes in the experimental group in both tests.

Topics	Discipline	Gender	Anxiety level	
			Test 1	Test 2
Topic 1	VB	Female	41	32
Topic 2	VB	Female	47	55
Topic 3	VB	Male	32	35
Topic 4	VB	Male	44	35
Topic 5	VB	Female	31	28
Topic 6	VB	Male	56	46
Average			42	38,14
P			0,19	

Based on the mean score of the Spielberger State Anxiety Inventory (Table 1), we noted that the mean state anxiety score of the experimental group always remained in the low range (36 to 45).

Although there was a drop in the mean level of anxiety-status between the two competitions, it is important to note that this difference was not statistically significant. Since the p-value is 0.19, indicating that the observed difference is not statistically significant at a significance level of 0.05 (or 5%), this means that we cannot assert that the protocol in place had an effect on lowering the level of anxiety-status before the competition.

4.2 Results of athletes in the Control group in both tests

Table 2 Anxiety-status results for control-group athletes in the two tests.

Subject	Discipline	Gender	Anxiety level	
			Test 1	Test 2
Topic 1	VB	Male	41	43
Topic 2	VB	Male	43	42
Topic 3	VB	Female	42	46
Topic 4	VB	Male	35	36
Topic 5	VB	Male	38	41
Topic 6	VB	Female	47	45
Average			41,86	42
P			0,87	

Based on the mean score of the Spielberger state-anxiety inventory, we also noted that the mean state-anxiety score of the control group of sprint athletes remained at the low level (36 to 45).

According to the results obtained from Table 2, we noted a slight increase in the mean anxiety-state of the control group between the first and second tests. This difference is not statistically significant. Since the p-value is 0.87 indicating that the difference observed is not statistically significant at a significance level of 0.05 (or 5%). This means that the athletes in the control group always maintained the same level of anxiety-status just before the two competitions, approximately one month apart. This result is consistent insofar as these athletes did not have

an experimental protocol or specific training that could improve their level of emotional control.

The results of the two groups in the two tests

Table 3. Anxiety-status results of the two groups in the two tests

Topics	Test 1		Test 2	
	Experimental Group	Control group	Experimental Group	Control group
1	41	41	32	43
2	47	43	55	42
3	34	44	37	48
4	45	37	37	36
5	33	38	30	41
6	58	49	48	47
Average	42,00	41,86	38,14	42,00
P	0,97		0,36	

According to the results presented in Table 3, we note that during Test 1, the state anxiety averages of the two groups are very close, and that this small difference is not statistically significant. The p-value is 0.97. This confirms that the two groups are almost identical at the start of our experimental protocol.

Turning to the results obtained in Test 2, we note that the anxiety-state averages of the two groups have changed, with a lower anxiety-state level in the experimental group than in the control group. This difference is not statistically significant. Since the p-value is

0.36, indicating that the observed difference is not statistically significant at a significance level of 0.05 (or 5%).

This means that the experimental protocol based on relaxation sessions had no effect on lowering the anxiety-state level in Sprinters prior to competition.

5. DISCUSSIONS

Anxiety-status, an important component of sporting emotions, can significantly influence athletes' performance, particularly in demanding disciplines such as sprinting. To help athletes better manage their stress, various psychological techniques, such as relaxation, have been explored in the literature. However, the results of this study, aimed at assessing the impact of a relaxation program on sprinters' anxiety-state levels before two competitions, showed no significant effect. This finding raises the question of the reasons for this discrepancy with previous research attributing a positive role to relaxation. An in-depth analysis of the results and a comparison with the existing literature will enable us to identify possible explanations and guide future research.

Analysis of the results shows that anxiety-status scores for both groups (experimental and control) remained at low levels (36 to 45) prior to both competitions. In the experimental group, a slight decrease in anxiety-status levels was observed after the intervention, but this difference was not statistically significant ($p = 0.19$). In the control group, a slight increase in state anxiety was observed, although this too was not significant ($p = 0.87$). These results show that, under the specific conditions of this study, the relaxation program had no significant effect on reducing state anxiety.

A comparison of the two groups revealed that their mean scores were similar at baseline, confirming their homogeneity before the intervention ($p = 0.97$). After the protocol, although the experimental group showed a slightly lower level of anxiety-status than the control group, this difference was not significant ($p = 0.36$). This suggests that, although relaxation may have contributed to a moderate reduction in anxiety, this effect was not strong enough to be statistically significant.

However, these results differ from many previous studies. Researchers such as Cox (2013) and Weinberg & Gould (2019) highlight relaxation as an effective technique for managing anxiety and stress in athletes prior to competition. According to these authors, relaxation exercises act by reducing physiological activation levels, thereby improving emotion regulation. In addition, Martens et al's (1990) multidimensional anxiety model shows that reducing cognitive anxiety through relaxation can have a direct effect on sporting performance.

This discrepancy with the literature can be explained by several factors. Firstly, the limited duration of the intervention - three relaxation sessions per week over one month - may have been insufficient to enable the athletes to effectively master the techniques proposed. Perna and Antoni (2005) point out that relaxation requires regular and prolonged practice to produce significant results. Secondly, the small sample size (14 athletes divided into two groups of 7) probably limited statistical power, preventing the capture of significant differences. According to Landers and Arent (2010), larger samples enable individual variations to be better assessed and conclusions generalized.

Another factor to consider is the participants' previous experience of stress management. Elite sprinters may already have effective strategies for managing their anxiety, reducing the impact of new techniques such as relaxation. This observation is consistent with Hanin's (2000) Individual Zones of Optimal Functioning (IZOF) model, which postulates that some athletes perform better in states of moderate arousal or anxiety. Finally, the methodology used, relying solely on the S.C.A.T to assess state-anxiety, may not have taken into account other important dimensions, such as cognitive or somatic anxiety, which also play a role in sports performance, according to Martens et al. (1990).

In conclusion, this study showed that the relaxation program implemented had no significant effect on reducing anxiety-status in sprinters prior to competition. Although positive trends were observed in the experimental group, they remained modest and statistically insignificant. These results differ from the work of Cox, Weinberg & Gould, and Martens, due to factors such as the limited duration of the protocol, the small sample size, and the specific characteristics of the participants.

CONCLUSIONS

Anxiety in athletes is a multifactorial issue influenced by psychological, contextual and individual variables. Although anxiety can have negative impacts on performance, it can also be used as a motivational driver if properly managed. The work of Martens, Hanin and others has provided sound theoretical frameworks for understanding this phenomenon, and personalized interventions

remain the key to helping athletes reach their full potential.

The relationship between anxiety and performance is influenced by factors such as the perception of anxiety, the type of sport, and the individual characteristics of the athlete. Interventions tailored to the specific needs of athletes can help transform anxiety into a lever for optimizing performance.

Despite some methodological limitations, this study shows the value of using a relaxation technique to improve sprint athletes' ability to control their emotional state prior to competition. The results of our study may encourage coaches and mental trainers to integrate relaxation sessions into mental training programs in order to reap its benefits.

The experiment set up in this study failed to validate the hypothesis put forward at the start of this work, namely that "relaxation can lower the level of anxiety-status in a sprint athlete close to competition". Nevertheless, it is important to point out that more studies, with a larger sample and a longer period of relaxation practice, will be needed to obtain results consistent with the literature.

OUTLOOK

Ongoing research into emotional management and relaxation highlights the importance of personalized approaches, tailored to the psychological characteristics and specific needs of athletes. Advanced technologies, such as neurofeedback, are set to play a growing role in this field.

For future research, it would be relevant to extend the duration of the interventions, involve a larger sample, and explore combined

approaches integrating relaxation, visualization and breathing techniques. In addition, qualitative analyses of athletes' perceptions could complement quantitative data to better understand the impact of relaxation techniques. These avenues will further our knowledge of the effectiveness of psychological interventions in the management of sports anxiety.

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