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Mental training generates positive effect on competitive anxiety of young swimmers?

O treinamento mental gera efeito positivo na ansiedade competitiva de jovens nadadores?

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Abstract – The aim of this research was to analyze the effect of mental training on the competitive anxiety of young swimmers. The sample consisted of 35 swimmers aged 15-17 years (M = 15.93; SD = 0.98), randomly divided into two groups: experimental group (EG, n = 17) and control group (CG, n = 18). The study lasted eight weeks. Both groups performed the same physical/technical training planning. CG watched advertisement videos while EG performed mental training. The Competitive State Anxiety Inventory (CSAI-2R) was administered to all athletes before the start of the season and the last week of the "taper" mesocycle. The findings revealed that the "cognitive anxiety" and "somatic anxiety" subscale scores attenuated from pre-test to post-test in EG (p = 0.01) and remained stable in CG (p = 0.15). The results showed that the "self-confidence" subscale score increased from pre-test to post-test in EG (p = 0.01) and remained stable in CG (p = 0.26). Significant difference was found in "cognitive anxiety" (p = 0.01), "somatic anxiety" (p = 0.01) and "self-confidence" (p = 0.01) subscales across EG and CG after 8 weeks. It was concluded that mental training was effective in reducing anxiety (cognitive and somatic) and increasing the self-confidence of young swimmers.

Key words: Athletes; Sport; Sport psychology.

Resumo – *O objetivo da pesquisa foi analisar o efeito do treinamento mental sobre a ansiedade competitiva de jovens nadadores. A amostra foi composta por 35 nadadores com idades entre 15 e 17 anos (M = 15,93; DP = 0,98), divididos aleatoriamente em dois grupos: experimental (GE, n = 17) e controle (GC, n = 18). O estudo teve a duração de 8 semanas. Ambos os grupos fizeram a mesma planificação de treinamento físico/técnico. O GC assistiu a vídeos de propagandas, ao passo que o GE realizou o treinamento mental. O Competitite State Anxiety Inventory (CSAI-2R) foi preenchido pelos atletas antes do início da temporada e na última semana do mesociclo "Polimento". Os achados revelaram que os escores das subescalas "ansiedade cognitiva" e "ansiedade somática" atenuaram do pré-teste para o pós-teste no GE (p = 0,01) e se mantiveram estáveis no GC (p = 0,15). Os resultados demonstraram que o escore da subescala "autoconfiança" aumentou do pré-teste para o pós-teste no GE (p = 0,01) e se manteve estável no GC (p = 0,26). Foi identificada diferença significante nas subescalas "ansiedade cognitiva" (p = 0,01), "ansiedade somática" (p = 0,01) e "autoconfiança" (p = 0,01) entre GE e GC após as 8 semanas. Concluiu-se que o treinamento mental foi eficiente para reduzir a ansiedade (cognitiva e somática) e aumentar a autoconfiança de jovens atletas de natação.*

Palavras-chave: *Atletas; Esporte; Sociologia do esporte.*

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INTRODUCTION

Anxiety is a multidimensional construct that deals with the disposition of response to stress and a tendency to perceive stressful situations[1]. One of the main research topics in the Sport Psychology area has been competitive anxiety, with the premise of understanding the main factors that influence it in the sporting environment[2]. Thus, considering the pressure concentration of the sporting environment to optimize performance, athletes of individual sports seem to show higher level of competitive anxiety compared with athletes of team sports[2]. Swimming it is considered an individual sport that has some peculiarities that, in a way, can generate competitive anxiety in athletes. For example, the visual contact of athletes with their opponents moments before the competition (control bank) and the possibility to hearing the announcer pronouncing their names and those of their opponents just before entering the water to compete[3-4].

The most adopted theoretical model has been the Multidimensional Theory of Competitive Anxiety[5], which subdivides competitive anxiety into two dimensions: cognitive anxiety and somatic anxiety, also considering a third dimension called self-confidence. Studies have revealed negative relationship between cognitive anxiety and sports performance[6-7]. Likewise, research findings have demonstrated that somatic anxiety adversely affects the performance of competitive athletes[8-9]. In contrast, according to Millet et al.[7], increased self-confidence can maximize the performance of athletes. In this sense, it is important to seek training strategies that can reduce anxiety (somatic and cognitive) and increase self-confidence in athletes. According to Wang et al.[10], mental training can be an effective strategy to improve cognitive variables of athletes.

Mental training, in turn, refers to the creation of mental imagery from sensory processes stored in the memory capable of being accessed without external stimuli[11]. According to the symbolic learning theory[12], a person is able to create a "mental sketch", which helps to carry out a particular task. In contrast, the psycho neuromuscular theory[13] states that imagination accesses the motor cortex and generates neuromuscular activation similar to performing a motor task.

According to Brick et al.[13], there are four mental training techniques: motivational-specific, motivational-general, cognitive-specific and cognitive-general. The first two are used to improve motivation and emotional control capacity, respectively. Cognitive-specific and cognitive-general mental training techniques are adopted by athletes in order to maximize the performance of a motor task or solve a situation that occurs in competition, respectively. Regardless of mental training technique adopted, studies have shown that mental training can be a good strategy to maximize the performance of athletes[10,14].

Although some scientific findings have revealed that mental training improves cognitive and / or physical performance of athletes[13-14], it is noteworthy that none of these studies was aimed at examining the effect of mental training on competitive anxiety in swimmers.

From a practical point of view, this type of research may reveal the effect of mental training on competitive anxiety in swimmers. In this sense, the findings may be extremely important for coaches of this sport. In this context, the aim of the study was to analyze the effect of mental training on competitive anxiety of young swimmers.

Whereas mental training seems to be able to improve the emotional control of athletes[13], three hypotheses were formulated: a) mental training reduces somatic anxiety; b) mental training reduces cognitive anxiety and; c) mental training increases self-confidence.

METHODOLOGICAL PROCEDURES

Participants

This is an experimental research conducted with male swimmers carried out in the second half of 2014 with duration of 8 weeks. The non-probabilistic sample consists of 38 state-level swimmers aged 15-17 years (15.93 ± 0.98) participating in the swimming championship of the state of Minas Gerais of youth or junior categories. All athletes were experts at 100m and / or 200m races and the target competition was the summer championship. Participants were randomly divided into two groups: experimental group (EG, n = 19) and control group (CG, n = 19). There were no significant differences for age ($F_{(2, 36)} = 2.44$, $p = 0.23$) and competitive anxiety ($F_{(2, 36)} = 1.23$, $p = 0.29$) between EG and CG before the investigation.

Swimmers trained on average 2 hours daily with frequency of five times per week of physical / technical training. To be included in the research, athletes should: a) be swimming athlete for at least two years; b) systematically train for at least 8 hours per week; and c) have qualifying time in the 100m and / or 200m races for the state championship (Minas Gerais), organized by the Aquatic Federation of Minas Gerais.

However, three athletes were excluded because they missed more than 5% of training sessions during the investigation (8 weeks). Therefore, the investigation included 35 swimmers in the final sample (EG = 17 and CG = 18).

After receiving information about the procedures they would be submitted to, participants signed the informed consent form. The coach of athletes signed the free and informed consent form (ICF), agreeing with the methodological procedures of this research. The procedures adopted in this study met the standards of the National Health Council Resolution 466/12 for research with humans. The project was approved by the Ethics Research of the Federal University of Pernambuco (CAE - 46978515.6.0000.5208).

Experimental design

Both groups (EG and CG) did the same physical / technical training planning in the course of 8 weeks (Table 1). Therefore, all athletes were submitted to the same training volume and intensity during the 8 weeks of research, including the "taper" period (last 4 weeks). It is noteworthy

that the distance covered in the microcycle was used to determine the training volume. The intensity of each microcycle was calculated from the average perceived exertion of each session (PSE-session), according to method already used in other scientific investigations[16-17]. No difference was identified in the perceived intensity of each microcycle between groups up to the end of the eighth microcycle ($F_{(2, 33)} = 2.63$, $p = 0.22$). Thus, the training intensity was similar between experimental and control groups during the entire investigation.

CG watched advertisement videos, while EG performed mental training. Swimmers performed 3 weekly mental training sessions interspersed with the period of 48 hours, totaling 24 sessions over 8 weeks. Sessions were conducted after physical / technical training, with a 30-minute interval between the end of the physical / technical training session and beginning of the mental training session. No mental training session was conducted without performing the physical / technical training. All mental training sessions lasted about 10 minutes and were conducted in a quiet environment at the water park (near the pool) with athletes wearing clothes they usually wear to compete. Videos of swimmers who have achieved success in competitive events were used before every mental training session in order to facilitate the imaginative ability of EG athletes. The recommendations of Brick et al.[13] were used for the development of the mental training protocol. Therefore, cognitive-general type imagination was adopted, asking athletes to imagine themselves in a competitive event since the environmental "control bank" (minutes preceding the test) until the end of the race. The following instructions were given to athletes: a) to build mental situation in the first person; b) to imagine the task at speed close to reality; c) to imagine positive situations during a competition; d) to generate emotions (anxiety and mood) similar to competition. It is noteworthy that all research participants had previous experience with cognitive-general type mental training sessions, although the present study protocol was partly different from the mental training program commonly done with these athletes.

The Competitive State Anxiety Inventory[18] (CSAI-2R) was filled by athletes before the start of the study, which was named as pre-test and the last week of mesocycle "Taper", named as post-test (summer championship eve). Although the CSAI-2R seeks to analyze the competitive anxiety of athletes, this psychometric tool can be used several times during a competitive season, since its reproducibility has been well established[5,18].

Instruments

The Brazilian version[18] of the Competitive State Anxiety Inventory (CSAI-2R)[5] was used to assess the competitive anxiety of athletes. The CSAI-2R consists of 16 items that measure three subscales: cognitive anxiety, somatic anxiety and self-confidence. The score for each subscale is calculated as the sum of the responses of items of each factor divided by the respective number of items. The frequency dimension of the CSAI-2R was adopted

the as evaluation criteria of competitive anxiety, which is arranged in a 4-point Likert scale ranging from 1 (none) to 4 (very). The higher the score, the greater the competitive anxiety magnitude. We opted for the use of the frequency dimension of the CSAI-2R because this dimension analyses the magnitude of competitive anxiety in the moment of its filling. Moreover, other scientific investigations have also adopted the frequency magnitude of the CSAI-2R[2,6]. The CSAI-2R has been validated for Brazilian athletes and demonstrated excellent psychometric properties[18]. For this sample, internal consistency of 0.78, 0.80 and 0.75 was identified (evaluated by Cronbach's alpha) for subscales cognitive anxiety, somatic anxiety and self-confidence, respectively.

Table 1. Physical / technical training periodization (8 weeks).

Mesocycle	Competitive					Taper		
Microcycle	1	2	3	4	5	6	7	8
Volume (m)								
40.000								
36.000								
32.000								
28.000								
24.000								
20.000								
16.000								
12.000								
8.000								
Intensity	80-100%					90-100%		

Demographic data (age, ethnicity, weekly training frequency and hours of daily training) were evaluated through a questionnaire constructed by researchers themselves.

Procedures

A priori, researchers contacted a coach of a swimming team from the state of Minas Gerais. Procedures and study objectives were properly explained and authorization to develop research with athletes was obtained.

Then, a meeting with swimmers was held in order to clarify all the ethical procedures of the research. In this meeting, the informed consent form was given to their respective coach for the participation of athletes. All athletes signed the consent form, agreeing with their voluntary participation in the research.

Data collection was carried out at the training site (water park). Athletes answered the CSAI-2R before the first microcycle. Then, athletes were randomly assigned into CG and EG.

Only 2 professionals (experienced in mental training area) conducted the data collection and mental training sessions for EG and videos for CG. Thus, athletes received the same verbal guidance and doubts were cleared.

Data analysis

The Shapiro-Wilk test was conducted to evaluate data distribution. The Levene's test was used to assess homescedasticity, while data sphericity was checked by the Mauchly's test. When this last assumption was violated, the Greenhouse-Geisser correction was adopted. Due to the non-parametric violation in both groups (EG and CG), we opted for the use of parametric techniques. Mean and standard deviation were used to describe all variables (CSAI-2R, age and training regimen). Multivariate analysis of covariance (MANOVA) of repeated measures was conducted to compare the scores of the CSAI-2R subscales between groups (EG and CG) according to the research stage (pre-test and post-test). The *post hoc* Bonferroni test was used to identify possible significant differences. Moreover, the Cohen's effect size was used, represented by the symbol "d" to point differences from the practical point of view. The following criteria were adopted, according to Thalheimer and Cook[19]: d <0.4 = low effect size, 0.4≤ d > 0.8 = moderate effect size and d ≥ 0.8 = large size effect. All data were analyzed with SPSS 21.0 software, adopting significance level of 5%.

RESULTS

Descriptive data of the pre-test phase [age and weekly training regimen (weekly training frequency x hours of daily training)] can be seen in Table 2.

Table 2. Descriptive values (mean and standard deviation) of the research variables

Variables	Mean	Standard Deviation
Age (years)	15.93	0.98
Weekly training regimen (hours)	10.15	0.76

% F = body fat percentage.

Regarding competitive anxiety, the results presented effects of time ($F_{(2, 33)}$ = 18.18, p = 0.01) and group ($F_{(2, 33)}$ = 23.60, p = 0.01) that are worth mentioning: a) the findings revealed that the scores of "cognitive anxiety" and "somatic anxiety" subscales attenuated from pre-test to post-test in EG ($F_{(2, 15)}$ = 16.89, p = 0 01, d = 0.5) and remained stable in CG ($F_{(2, 16)}$ = 3.47, p = 0.15, d = 0.1); b) the results showed that the score of the "self-confidence" subscale increased from pre-test to post-test in EG ($F_{(2, 15)}$ = 29.05, p = 0.01, d = 0.9) and remained stable in CG ($F_{(2, 16)}$ = 2.19, p = 0.25, d = 0.1) and; c) significant difference was found in "cognitive anxiety" ($F_{(2, 33)}$ = 21.11, p = 0.01, d = 0.5) "somatic anxiety" ($F_{(2, 33)}$ = 27 , 54, p = 0.01, d = 0.5) and "self-confidence" ($F_{(2, 33)}$ = 39.92, p = 0.01, d = 0.8) subscales between experimental and control groups in post-test as seen in Table 3.

Table 3. Mean and standard error of the CSAI-2R subscales according to research phase (pre- and post-test) and group (CG vs EG)

	Cognitive anxiety		Somatic Anxiety		Self Confidence	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
CG	12.82 (±1.94)	12.95 (±1.87)*	14.33 (±1.99)	14.12 (±2.02)*	13.63 (±1.89)	13.50 (±1.92)*
EG	12.45 (±2.06)	9.07 (±1.83)[a]	14.56 (±2.08)	11.18 (±1.91)[a]	13.49 (±1.75)	17.31 (±1.82)[a]

EG = experimental group; CG = control group; p <0.05 compared to pre-test; * P <0.05 difference between CG and EG.

DISCUSSION

The aim of this investigation was to analyze the effect of mental training on competitive anxiety of young swimmers. The findings showed that mental training was able to reduce cognitive and somatic anxiety, while generating increased self-confidence after 8 weeks of training, confirming the hypothesis of the research. However, comparisons with results of other investigations are impractical due to the uniqueness of this study.

The results of this research indicated decrease in the magnitude of cognitive anxiety in EG after 8 weeks of mental training, which was not observed in CG. Moreover, moderate effect size between CG and EG in the post-test was found, indicating reasonable probability of this finding to be true for swimmers with similar characteristics to the present study. In this sense, it seems that 30 minutes of mental training per week (three 10-minute sessions spaced with 48 hours) can reduce cognitive anxiety. According to Di Rienzo et al.[20] and Fernandes et al.[6], high cognitive anxiety in competition eve leads to increased muscle tension, which in turn can lead to increased muscle stress, resulting in reduced performance and anaerobic resistance. Therefore, 100m and 200m races require maximized anaerobic resistance[21], and it could be inferred that increasing cognitive anxiety produces reduced performance in swimmers. Thus, mental training can be used as a strategy to increase performance in swimming competitions.

In addition, according to Fernandes et al.[2], cognitive anxiety is considered responsible for the reduction of concentration and decision-making. Thus, considering that 100m and / or 200m races (e.g., 200m medley, 100m butterfly and 200m breaststroke) need good pacing strategy[4], which in turn requires concentration and decision-making, perhaps the high magnitude of cognitive anxiety can generate early fatigue in swimmers due to poor pacing preparation. Thus, mental training, in a way, can be effective in increasing the performance of swimmers in tests that require good pacing strategy.

The findings showed decreased somatic anxiety after eight weeks of training in EG, which was not observed in CG. In addition, moderate effect size between CG and EG in the post-test was found, which shows reasonable probability of this result to be true for young swimmers with characteristics similar to this research. A study has shown that somatic anxiety increases cardiovascular, neuromuscular and neuroendocrine stress[7]. Thus, considering that increased organic stress moments before competition is related to reduced muscle and cognitive performance[9], perhaps somatic anxiety can generate decreased performance in swimmers. Thus, indirectly, mental training can be adopted as a somatic anxiety reduction strategy, therefore increasing the competitive performance of young swimmers. According to Patel et al.[9], high somatic anxiety magnitude is associated with increased psychophysiological fatigue. In this sense, reduced somatic anxiety coming from mental training seems to be essential to inhibit early fatigue in athletes, which may result in performance improvement in competition.

Regarding self-confidence, the results showed an increase in EG and maintenance in CG after 8 weeks of training. High effect size has been identified when comparing CG and EG in the post-test, indicating a high probability that mental training increases self-confidence in swimmers with characteristics similar to the present study. Studies have revealed that increased self-confidence can generate positive effect on the performance of athletes[2,6]. Therefore, considering the findings of this research, mental training, in a way, can be an effective strategy for maximizing sports performance. However, Fernandes et al.[1] point out that overconfidence can be detrimental to athletic performance. Thus, coaches should know their athletes to identify the magnitude required so that increased self-confidence maximizes performance in competitions.

It is noteworthy that self-confident athletes often show better sporting results compared to athletes with low self-confidence levels[2]. In addition, the findings of some investigations have shown positive relationship between self-confidence and athletic performance[7,9]. Thus, building mental situation in the first person, imagining the task at speed close to reality, positive situations during a competition and generating emotions (anxiety and mood) similar to competition seem to be cognitive strategies essential to increase the competitive self-confidence of swimmers, which, in a way, can result in increased performance in competitions.

Although revealing interesting results, this study has limitations that should be mentioned. Brain and electromyographic signals have not been evaluated during mental training sessions in EG and videos in CG. The use of questionnaire is also a limitation. According to Fortes et al.[22], the use of questionnaire in Likert scale in investigations with repeated measures can generate learning effect. Thus, the findings should be interpreted with caution.

CONCLUSION

Finally, the results showed that cognitive-general type mental training was effective in reducing anxiety (cognitive and somatic) and increasing self-confidence of young state-level athletes, competitors of 100m and / or 200m swimming races. In this sense, it is recommended that cognitive-general type mental training is included in the training routine of state-level young swimmers.

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