

## Anxiety changes did not influence performance of young swimmers

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### Abstract:

Anxiety is the main emotion, which influences life quality and competitive performance. The purpose of this study was to evaluate anxiety levels on different training phases during a semester season and to analyze the relation between anxiety and athletic training of adolescent swimmers. Twenty swimmers were included, 13 men with an average age of  $15.6 \pm 1.8$  years old, and 7 women with an average age of  $13.4 \pm 0.7$  years old. The swimmers were asked to answer the Trait Anxiety (TA) and Anxiety State (SA) inventories during one season, which had five periods of preparation for a major competition. Results showed that there was no significant difference on the performance ( $p > 0.05$ ) when compared base and competition periods to all swimmers, or when analyzed per gender or age categories. The change of swimming race time (base and competition period) of girls ( $0.6 \pm 3.3$  s) and boys ( $0.1 \pm 7.9$  s), also was compared, but there was no significant difference between them ( $p = 0.97$ ). We concluded that the girls presented higher scores to anxiety in the competitive period compared to boys. As well as infantile category showed higher state anxiety scores compared to juvenile. However, there was no correlation between changes of anxiety scores and performance.

**Key Words:** Anxiety - Swimming - Training - Performance

### Introduction

Psychological factors have been one of the most debatable external factors on sport science context and health. In this context, sport psychology is the science that studies emotional aspects related with changes in physical performance (Karlsson, Gerdle, Takala, Andersson, & Larsson, 2016), being emotional variables, such as aggressivity, depression, stress and anxiety, associated with life quality and competitive performance (Karlsson et al., 2016).

Among these psychological parameters, anxiety is one of the most emotion evaluated variable related with athlete's skill on the sports field (Ford, Ildefonso, Jones, & Arvinen-Barrow, 2017). Indeed, anxiety can be classified as: trait anxiety (TA; cognitive component, a pre-disposition in behavior, that induces an individual perceiving objectively not very dangerous situations as threats) or state anxiety (SA; whose subjective feelings are consciously perceived as inadequate, accompanied by an increase in the activation of the autonomic nervous system, making it a temporary emotional condition) (Ford et al., 2017).

To achieve a high performance level in the swimming modality it is necessary to work hard. However, during the periodization of training the athlete has a specific set of unpleasant emotional situations (i.e., anxiety, discouragement and anger), which could influence the recovery and final competition results (Vacher, Nicolas, Martinet, & Mourot, 2017a).

In this context, swimming, as well as other sports, requires a well-organized training program in order to achieve expected results, as well as optimal control of intensity and volume throughout the training season. Indeed, previous studies have been questioned the influence of anxiety level on competitive performance, as well as the ability of genders to cope with anxiety during competition (Hagan, Pollmann, & Schack, 2017).

Apart from influence of anxiety and high intensity training in which athletes are submitted during preparation phases, an overtraining syndrome may be noted (Vacher, Nicolas, Martinet, & Mourot, 2017b). Although, the pressure for success is one of the key factors that increased the level anxiety and interfere players' performance in sport (Horikawa & Yagi, 2012). Thus, the purpose of this study is to evaluate anxiety levels on different training phases during a semester season. Our hypothesis was that higher intensity periods would increase state anxiety and influence the performance on sport.

### Material & methods

#### Participants

Twenty trained swimmers (N = 13, males;  $15.6 \pm 1.8$ ; N = 7 females,  $13.4 \pm 0.7$  years respectively), were included in this study. All participants should be healthy, aged between 13 and 18 years and competitive

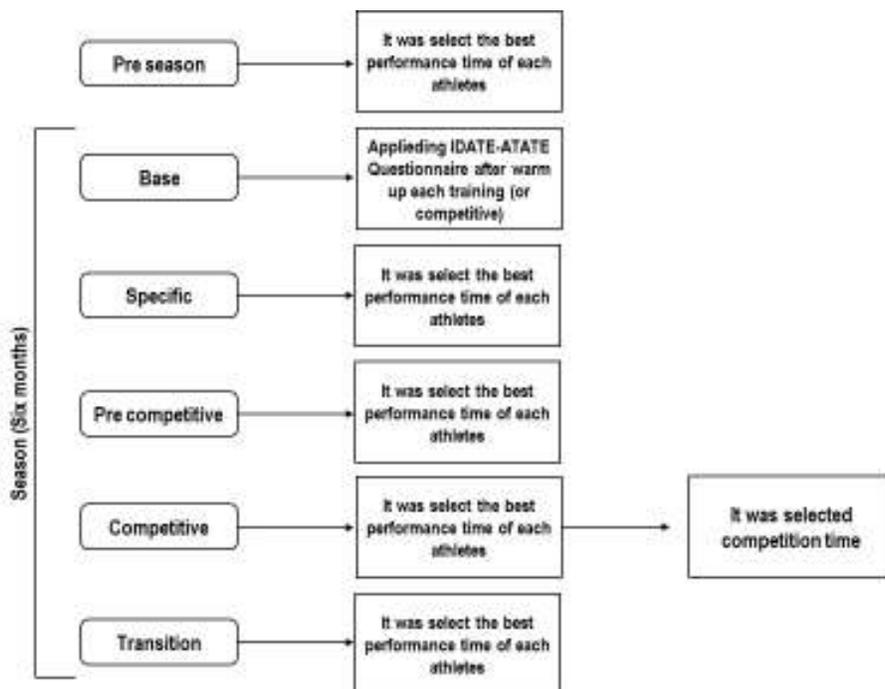
swimmers at the recreational, state or national level, regularly engaged in the training program. Exclusion criteria adopted were: 1) less than 6 months of competitive training; 2) smoking history during the last 3 months; 3) presence of any cardio-vascular disease; 4) use of creatine supplementation; 5) use of anabolic androgen steroids or 6) recent musculoskeletal injury. This study was approved by the local institutional Ethical Committee for Human Experiments (N. 35207514.8.0000.5154/2016) and was performed in accordance with the ethical standards in sports science research (Harriss & Atkinson, 2015). In addition, all participants signed an informed consent form.

*Experimental design of the study*

The present study is observational, longitudinal and quantitative, both TA and SA were analyzed during the training period of young swimmers, comparing both sexes, in the categories Childlike, Juvenil and Júnior, with the result of the main competition of each category. Was made anthropometrics measures (weight and height) in each individuals.

The Spielberger et al. adapted trait and state anxiety questionnaire was applied to evaluate the anxiety of athletes (Balsamo et al., 2013; Rodrigues, Pandeirada, Bem-Haja, & França, 2018). The same experienced researcher applied the questionnaire for all athletes during five periods of the training season: general, specific, taper, competitive and transition. Trainers identified each period of training and the interventions occurred at half time of each period. The competitive period was schedule based on the mains competition of the season.

All interventions were carried out immediately prior warm-up, on each training (or competitive) days (e.g., as shown in Figure I). The IDATE-STATE questionnaire was applied after warm up and 10 min prior the main competition event. The best time trial of each athlete, achieved on pre-season, was considered as control to the competition time.



**Figure I:** show the experimental design.

*Statistical analysis*

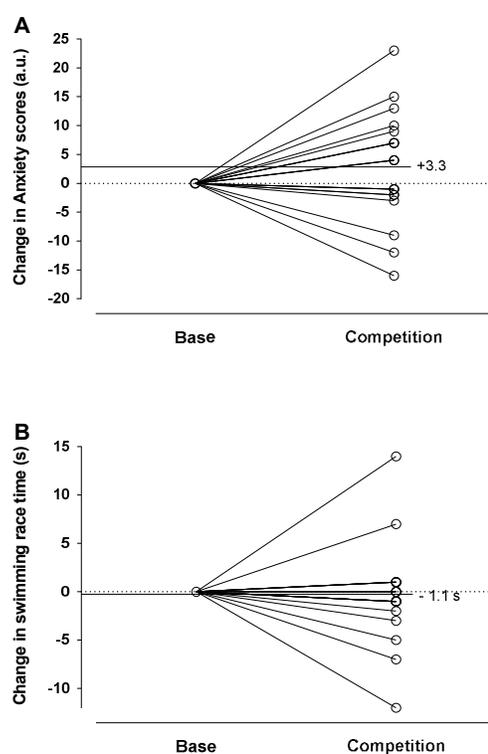
The software GraphPad® (Prism 6.0, San Diego, CA, USA) was used for data analyses. The normality of the data was verify with the Shapiro-Wilk test. To compare performance between base and competition periods, the Wilcoxon test was performed to all swimmers, only boys and per each category, and paired t-test to compare only girls' performance. The trait anxiety (TA) and state anxiety (SA) questionnaires were analyzed by one-way analyses of variance (ANOVA) for repeated measurements or Friedman's test followed by Bonferroni or Dum post-hoc test, respectively, to compare the periods of competitions on all swimmers and per category. Moreover, also for analyze the TA and SA responses, two-way ANOVA for repeated measurements followed by Bonferroni's post-hoc test were conducted for compare trait and state anxiety scores for each training season phases and the girls and boys during all periods of training. For measurement of the correlations between the change in SA and change swimming performance in the base and competitive periods, Pearson's bivariate correlations test was performed. Ultimately, Kruskal-Wallis test was performed for analyze possible difference

on the TA and SA questionnaires' responses among categories on each period of training. Level of significance was of the 0.05.

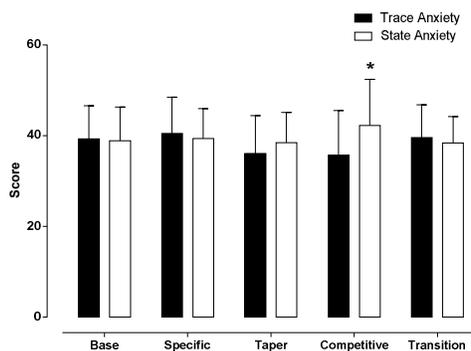
### Results

There was no significant difference on the performance ( $p > 0.05$ ) when compared base and competition periods to all swimmers (e.g., as shown in Figure II), or when analyzed per gender (e.g., as shown in Figure IV) or age categories (e.g., as shown in Figure V). The change of swimming race time (base and competition period) of girls ( $0.6 \pm 3.3$  s) and boys ( $0.1 \pm 7.9$  s), also was compared, but there was no significant difference between them ( $p = 0.97$ ). The change of the anxiety scores in the base and competition periods of all swimmers did not present difference, but the state anxiety showed higher scores compared to trait anxiety in the competitive period (e.g., as shown in Figure III). Following the state anxiety, the girls presented higher scores to anxiety in the competitive period compared to boys, and the junior category presented change in the anxiety in the competitive period compared to all others periods of training (e.g., as described in Table II). In addition, infantile category showed higher anxiety scores in state anxiety compared to juvenile (e.g., as described in Table II).

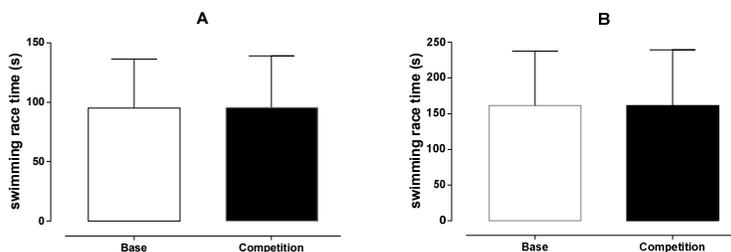
No significance correlation between changes of anxiety scores and swimming race time in the base and competition periods of all swimmers was found (state anxiety  $p = 0.35$ ,  $r = 0.22$ ; trait anxiety,  $p = 0.57$ ,  $r = 0.13$ ).



**Figure II:** Change in anxiety scores (A) and change swimming race time (B) in the base and competition periods of all swimmers.



**Figure III:** Trait and State anxiety scores for each training season phases. \* $p = 0.02$  vs Trait Anxiety in the competitive period.

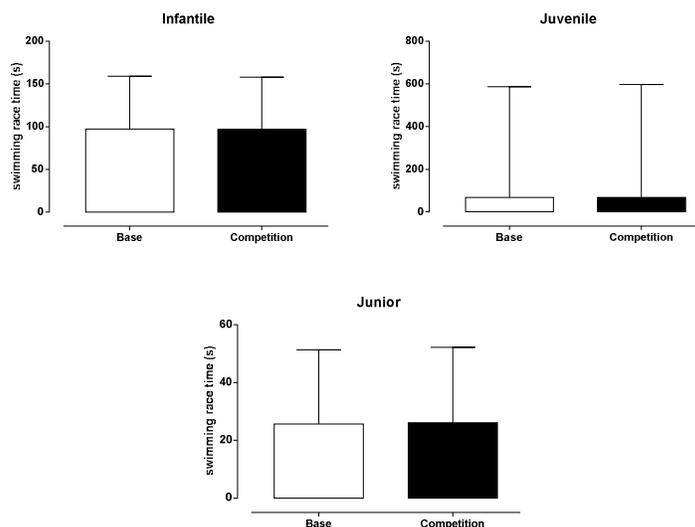


**Figure IV:** Swimming race time of girls (A) and boys (B) in the base and competition periods. Data are in mean  $\pm$  standard deviation.

**Table I -** State and Trait anxiety scores for gender categories during training season.

	Girls (n=7)		Boys (n=14)	
	Trait Anxiety	State Anxiety	Trait Anxiety	State Anxiety
Base	42.6 $\pm$ 8.1	41.0 $\pm$ 9.5	37.8 $\pm$ 6.1	37.9 $\pm$ 6.3
Specific	43 $\pm$ 8.8	40.9 $\pm$ 4.6	39.2 $\pm$ 7.6	38.6 $\pm$ 7.5
Taper	36.0 $\pm$ 6.3	40.0 $\pm$ 8.7	36.1 $\pm$ 9.4	37.7 $\pm$ 5.6
Competitive	39.7 $\pm$ 11.6	51.3 $\pm$ 8.5*	33.7 $\pm$ 8.5	37.7 $\pm$ 7.8
Transition	43.0 $\pm$ 8.3	37.7 $\pm$ 4.4	37.9 $\pm$ 6.2	38.8 $\pm$ 6.6

Data are in mean  $\pm$  standard deviation. \*Represent significance difference to boys in the same period and state anxiety,  $p = 0.014$ .



**Figure V:** Swimming race time of the all categories in the base and competition periods. Data are in median  $\pm$  interval interquartile.

	Infantile (n=11)		Juvenile (n=5)		Junior (n=5)	
	Trait Anxiety	State Anxiety	Trait Anxiety	State Anxiety	Trait Anxiety	State Anxiety
Base	44.0 $\pm$ 12.0	38.0 $\pm$ 13.5	36.0 $\pm$ 9.5	33.0 $\pm$ 13.0	45.0 $\pm$ 11.5	42.0 $\pm$ 7.5 <sup>a</sup>
Specific	47.0 $\pm$ 15.0	40.0 $\pm$ 7.5 <sup>c</sup>	34.0 $\pm$ 9.0	31.0 $\pm$ 9.0	40.0 $\pm$ 15.0	38.0 $\pm$ 8.0 <sup>b</sup>
Taper	35.0 $\pm$ 12.0	39.0 $\pm$ 16.0	31.0 $\pm$ 11.0	34.0 $\pm$ 9.0	36.0 $\pm$ 16.5	38.0 $\pm$ 7.0 <sup>c</sup>
Competitive	45.0 $\pm$ 26.0	52.0 $\pm$ 18.5	35.0 $\pm$ 18.0	43.0 $\pm$ 19.0	28.0 $\pm$ 15.0	34.0 $\pm$ 8.0 <sup>d</sup>
Transition	44.0 $\pm$ 16.0	38.0 $\pm$ 7.0	38.0 $\pm$ 9.5	33.0 $\pm$ 13.0	45.0 $\pm$ 11.5	42.0 $\pm$ 8.

**Table II-** State and Trait anxiety scores for age categories during training season. Data are in median  $\pm$  interval interquartile. The “a, b, c, d” represent significance difference in periods of training within the same category

and state anxiety, where: a: vs competitive,  $p = 0.02$ ; b: vs competitive,  $p = 0.01$ ; c: vs competitive,  $p = 0.01$ ; d: vs transition,  $p = 0.00$ . The “e” represent significance difference to Juvenile in the state anxiety and same period,  $p = 0.02$ .

## Discussion

A previous study explored the specific set of emotional states (i. e., Happiness, excitement, anxiety, dejection and anger) in high level swimmers during a four months training period. The authors identified during the training periodization a significant relationship with the anxiety, dejection and anger, where this emotions increased and after this period there was a decrease (Vacher et al., 2017a). This find agree with our results shows higher state anxiety scores compared to trait anxiety in the competitive period (Figure 3). Despite it was not find present difference of the anxiety scores in the base and competition periods of all swimmers together.

Manifestation of trait anxiety may result in a negative emotional state in which the individual perceives the conditions of the environment as disproportionately threatening, generating nervousness and worry associated with higher activation and agitation of the organism, which in case of competitive period the pressure that athletes suffer is higher (Weber et al., 2018).

According to a few systematic review these negative emotion are expected to trigger biological response like activation of sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis. This event causes tachycardia, release of cortisol, release of adrenaline and among others (Van Paridon, Timmis, Nevison, & Bristow, 2017).

Following the state anxiety, the girls presented higher scores to anxiety in the competitive period compared to boys (Table 2). Earlier studies claim that women suffer more anxiety because of the prejudice caused by the role of women in sports. This cultural environment in which women are inserted has a detrimental influence on sport, since external factors related to young athletes such as lack of support from parents, coaches and other things serve as a barrier, the size of the sample in the present study, shows this gender inequality since there were fewer women than men (Nogueira, Molinero, Del Valle, Lucidi, & Márquez, 2018; Tafflet et al., 2011; Trolan, 2013).

The infantile category presented higher scores in the A.S level in the competitive periods in relation to juvenile (Table 2). According to a previous study, this fact can be caused by the environment in which the athletes are inserted (i.e., competitive environment) (Hagan et al., 2017). However, the result cited contradict the study by Grossbard et al., Who according to the authors, anxiety levels should be higher in the older categories compared to the younger ones because the maturity and requirement of the level of performance are higher and this causes the volume and intensity of training are high (Grossbard, Smith, Smoll, & Cumming, 2009).

The anxiety scores of the junior category in the competitive period compared with the other periods decreased. A study predicted that he used Jones' control model, measured the intensity and interpretation of symptoms associated with competitive trait anxiety in sport with rude and explosive motor skills. The main finding of this study was that the level of competitive experience influences the interpretation of symptoms usually experienced in situations of pressure (Mellalieu, Hanton, & O'Brien, 2004). One possible explanation for the change in anxiety in the competitive period compared to all other periods is the influence of experience and the ability to interpret the symptoms associated with the competitive trait anxiety of junior athletes which helped to decrease the level of anxiety in the period competitive.

When the results were analyzed by performance, there was no significant difference between base and competitive periods to all swimmers (Table 2) or when analyzed per gender (Figure 4) or age categories (Figure 5). Therefore, the change of swimming race time (base and competition period) of girls and boys also were compared, but there was no significant difference between them. A review study analyzed the importance periodization of the annual training cycle for elite athletes practicing team sport games. According to this manuscript, the elaboration of a good periodization with different types of micro, meso and macrocycles, associated two or three competitive are necessary to increase the performance to competitive (Lyakh et al., 2016). A hypothesis for ours findings is that we had no influence on the training program during season, and maybe this can be a factor that influenced on the comparison of swimmers' performance. Regarding the non-difference between boys and girls maybe this fact occurred due to the growth and development process, where this period motor ability and physical performance (Brown, Patel, & Darmawan, 2017).

The correlation between changes in anxiety scores and swimming race time was trivial (Hopkins, Marshall, Batterham, & Hanin, 2009) and non-significant. A study that investigated the prevalence of psychological distress among young elite athletes shows physical activity above the recommended levels for this age group predicted psychological distress among the controls which seems to be related to our finding. According to the authors, participation in sport can promote mental and physical wellbeing as well as functional coping with stress and anxiety (Rosenvinge et al., 2018). Maybe the athletes were able of coping with anxiety and this do not interfered in the performance results.

We believe that the results may help the coaches who are at the forefront of the teams involved in evaluating training planning, including encouraging them to add psychological training in periodization to provide better results for athletes whose anxiety is negatively influencing training and competition. In fact,

coupled with the adolescent lifestyle (Chyi, Lu, Wang, Hsu, & Chang, 2018), a psychological methodology will help maintain mental health and a better quality of life.

There is also the suggestion for the hypothesis of the correlation of physiological markers of emotional states with the IDATE instruments for future research in the field of sports psychology in competitive swimming. This study is characterized observational, longitudinal and quantitative. However, there was no control of training variables in periodization through the researchers, which is a possible limitation for this study.

### Conclusions

We concluded that the girls presented higher scores to anxiety in the competitive period compared to boys. As well as, infantile category showed higher state anxiety scores compared to juvenile. However, there was no correlation between changes of anxiety scores and performance.

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