Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia - Social and Behavioral Sciences 33 (2012) 885 – 889

Procedia
Social and Behavioral Sciences

PSIWORLD 2011

# The relation between anxiety, reaction time and performance before and after sport competitions

Manuela Mihaela Ciucurel*

*University of Pitesti, Targu din Vale no. 1, Pitesti, 110040, Romania*

**Abstract**

We aimed to evaluate the relationship between anxiety, reaction time and motor performance before and after sports competitions. We conducted a correlational study (N = 70 men, mean age 20.3 years, athletes) and we used as instruments The Anxiety Inventory - STAI, proposed by Spielberger et all., a software for measuring the simple reaction time to the appearance of a visual stimulus on the screen and a motor performance assessment test. Our findings suggest the importance of psychological monitoring of elite athletes and the necessity of including of the tested variables in a psychological training program.



*Keywords*: anxiety; motor performance; reaction time; athletes.

## 1. Introduction

There are several studies that have looked at the relationship between motor performance and anxiety, motor performance and reaction time, most of them claiming correlational or causal relationships between these variables, mostly in a dyadic approach (Panayiotou & Vrana, 2004; Hainaut, Monfort, Bolmont, 2006; Whelan, 2008).

Individual's reaction time plays a crucial role in all forms of sport and is determinant in the unfolding of a competition where the attending athletes have reached the same level of physical training.

Athletes' simple reaction time depends on several variables: type of stimulus (Sanders, 1998); arousal or state of attention, including muscular tension (Etnyre & Kinugasa, 2002; Davranche & al., 2006; Masanobu & Choshi, 2006); age (Der & Deary, 2006); gender (Der & Deary, 2006); fatigue (Van den Berg & Neely, 2006); effect of distraction (Trimmel & Poelzl, 2006); personality type (Lenzenweger,

* Ciucurel Manuela Mihaela. Tel.: +40751880592;
*E-mail address*: mciucurel@yahoo.com.

 doi:10.1016/j.sbspro.2012.01.249

2001; Robinson & Tamir , 2005); exercise (Nakamoto & Mori, 2008); stress and anxiety (Panayiotou, 2004).

Some studies have concluded that anxiety increases activation, but leads to behavioral inhibition (Ciucurel, 2005). Other studies show that high anxiety facilitates performance in easy tasks and blocks performance in complex, difficult tasks (Etnyre & Kinugasa, 2002). Also, increases in the anxiety levels lead to the increase of the nervous activation (arousal), as well as to the rise of the avoidance motivation (Hackfort & Spielberger, 1990).

The relation between anxiety and motor performance could be explained in various ways: anxiety may impair external performance, as a function of attentional interference (Calvo, Alamo & Ramos, 1990), an attentional interpretation of the anxiety and motor performance relationship (Mullen & Tattersall, 2005), a psychobiological approach which implies affect and cognition as well as physiology (Neiss, 1988) and so on.

## 2. Objectives and Method

We aimed to evaluate the relationship between anxiety, reaction time and motor performance before and after sports competitions.

We conducted a correlational study and we used as instruments The Anxiety Inventory - STAI, proposed by Spielberger et all., a software for measuring the simple reaction time to the appearance of a visual stimulus on the screen and a motor performance assessment test.

Our research has undergone the following stages: a) the diagnosis of the anxiety level in a group of athletes; b) the diagnosis of the reaction time in that group of athletes; c) the assessment of the motor performance; d) the analysis of the relation between those parameters.

We have hypothesized that there are differences between athletes' anxiety, reaction time and motor performance, depending on the moment the assessment was conducted (before or after sports competitions).

To conduct this correlational study we have used a sample of 70 athletes (all participants were men). The group was homogenous in terms of age, with a mean age of 20.3 years (SD = 0.95 years). The athletes were practicing individual sports (there were four categories represented here: judo, kayak-canoe, swimming, tennis); we have used this selection criteria because there are studies showing that there is a relation between practicing a team sport and a lower anxiety level (it is argued that the existence of the team creates a facilitating effect and provides social support).

## 3. Results and discussion

The first research hypothesis stated that there are differences between athletes' anxiety, depending on the moment of assessment (before and after sports competitions). Data were first analyzed separately for the two moments of assessment, using descriptive procedures. Both state-anxiety and trait-anxiety scores were analyzed.

Before the competition, the following data were obtained:

- the mean state-anxiety score for the group was 52.55 points (SD = 7.21 points), indicating a level of state-anxiety above the medium;
- the mean trait-anxiety score for the group was 43.38 points (SD = 6.47 points), indicating a medium level of trait-anxiety.

We can notice that, before the competition, the level of state-anxiety was a bit higher than the level of trait-anxiety (the significance of results according to test norms being different).

After the competition, the following data were obtained:

- the mean state-anxiety score for the group was 41.55 points (SD = 10.21 points), indicating a medium level of state-anxiety – a lower level than before the competition; we can also notice that the variance of scores was higher than before the competition, indicating a greater diversity of anxious reactions after the competition;
- the mean trait-anxiety score for the group was 42.38 points (SD = 6.36 points), indicating a medium level of trait-anxiety – a little lower that before the competition.

We can notice that, after the competition, the level of state-anxiety and the level of trait-anxiety are similar. To compare the levels of anxiety between the two moments of assessment, we have used the Paired samples t-test. Results indicate that there are no significant differences between the two moments of assessment as far as the trait-anxiety is concerned ($t = 4.26$, $p = .08$). Nevertheless, such differences were found for the state-anxiety ($t = 16.78$, $p < .05$, Cohen's $d = 1.24$); the level of state-anxiety is higher (above the medium level) before the competition than after the competition (medium level of anxiety). Statistical support for our first hypothesis exists only for the state-anxiety.

Our second research hypothesis stated that there are differences between athletes' reaction time, depending on the moment of assessment (before and after sports competitions).

Before the competition, the reaction time for our group had a mean value of 218.1 ms (SD = 12.1 ms). After the competition, the reaction time for our group had a mean value of 222.9 ms (SD = 11.38 ms). Using the Paired samples t-test we have obtained that there are significant differences between the reaction time assessed before and after the sports competitions ($t = 18.21$, $p < .05$, Cohen's $d = -0.40$). Before the competition the reaction time is lower (athletes have more rapid reactions), probably due to activation; the higher values for the reaction time obtained after the competition may indicate decrease of motivational tensioning and muscular fatigue.

The third research hypothesis stated that there is a relation between athletes' anxiety and their reaction time, both before and after sports competitions.

Before the competition, we have found a negative, moderate and statistically significant correlation between the state-anxiety and the reaction time ($r = -.53$, $p < .001$); thus, an increase in the state-anxiety is associated with a decrease in the reaction time; due to activation, athletes become more rapid, seemingly anticipating the appearance of the visual stimulus on the screen. The moments before the competition are characterized by preparation states and cognitive-affective and motivational sets that reduce responses' latency.

Also before the competition, a moderate and statistically significant correlation was found between the trait-anxiety and the reaction time ($r = .34$, $p < .001$). The direction of the association is a direct one - that is, when the trait-anxiety increases, the reaction time also raises. A higher structural level of anxiety will thus be associated with a significant latency of responses, the subject having major difficulties in concentrating on the work task. Results are similar with the ones obtained in the literature concerning the relation between structural anxiety and response's latency for complex tasks (Hainaut, Monfort, & Bolmont, 2006).

After the competition, we have found a negative, moderate and statistically significant correlation between the state-anxiety and the reaction time ($r = -.42$, $p < .05$); thus, an increase in the state-anxiety is associated with a decrease in the reaction time (more rapid reactions). The state-anxiety of the athletes was found to be lower after the competition (medium level of state-anxiety); this explains why the activation (arousal) state induced by anxiety is associated with a lower latency for simpler tasks (such as the one implied by our reaction time test).

Also after the competition, a weak, positive and statistically significant correlation was found between the trait-anxiety and the reaction time ($r = .29$, $p < .05$). A higher structural anxiety will be associated with a significant latency in athletes' responses.

The forth research hypothesis stated that there are differences between athletes' motor performance, depending on the levels of anxiety and reaction time. To test this hypothesis we have used the Analysis of Variance procedure. For this reason we have coded both the anxiety level (total score) and the reaction time dichotomically (high versus low). The dependent variable was represented by scores obtained on motor performance test. Data obtained before and after sports competitions were analyzed separately.

Before the competition, we have found that the highest motor performance was obtained by athletes having low anxiety and low reaction time (mean = 9.30), followed by the ones having low anxiety and high reaction time (mean = 8.90). In contrast, athletes with high levels of anxiety had increasingly lower motor performance (mean = 6.50 for low reaction time and mean = 4.60 for high reaction time).

For our group of 70 athletes, the analysis showed both a main effect of the factors (factor 1 – anxiety and factor 2 – reaction time) and an interaction effect (anxiety * reaction time).

We have obtained that the anxiety level, coded dichotomically (high versus low), has a statistically significant main effect on the motor performance ($F = 159.9$, $p < .001$). The athletes having a low anxiety level tend to obtain significantly higher motor performances compared with the more anxious ones.

Also, the reaction time (coded dichotomically - high versus low) has a statistically significant main effect on the motor performance ($F = 7.1$, $p = .009$). The athletes having low response latency (low reaction time) tend to obtain significantly higher motor performances compared with the ones having high response latency (high reaction time)

An interaction effect was also noted; the interaction between the anxiety level and the reaction time was statistically significant ($F = 16.8$, $p < .001$). Thus, athletes having low anxiety and low reaction time (athletes that are more rapid) have significantly higher motor performances compared with the ones having low anxiety and high reaction time and, especially, compared with the ones having high anxiety (irrespective of the latency of their responses).

Studies in the field show that a high anxiety before the competition is associated with a decrease in the reaction time, due to the activation effect (a results we have also obtained in our research), but at the behavioral level it can be noted a disorganization effect – probably due to coordination difficulties.

There is a subgroup of athletes characterized by high anxiety and high reaction times – characteristics that are reflected in behavioral inhibitions and a marked decrease in motor performances. In practice, it is this subgroup of athletes that poses the most difficulties in the psychological training for competition.

After the competition, we have found that the highest motor performance was obtained by athletes having high anxiety, irrespective of the reaction time (mean = 8.45). The level of anxiety created a difference, but the reaction time did not.

For our group of 70 sportsmen, the analysis showed only a main effect for factor 1 – anxiety. We have obtained that the anxiety level, coded dichotomically (high versus low), has a statistically significant main effect on the motor performance ($F = 101.9$, $p < .001$). After the competition, the athletes having a high anxiety level tend to obtain significantly higher motor performances compared with the less anxious ones. This may be explained by the fact that, after the sport event, an echo-like anxiety remains, that keeps the level of activation high, but is no longer accompanied by the burden of the personal responsibility for the competition. It may be that those persons had reached their peak-potential too late.

The reaction time had no individual effect on the motor performance after the competition ($F = 0.1$, $p = 0.8$), nor did the interaction between the two factors ($F = 0.1$, $p = 0.8$).

## 4. Conclusions

Concerning the relation between anxiety, reaction time and performance, before the competition we note that some anxious athletes have the tendency to obtain significantly better reaction times, but this is associated with disorganization at the behavioral level, with the decrease of motor performance. The other

anxious athletes have an increase in the response latency, a fact that is associated with behavioral inhibition and the reduction of motor performance.

After the competition this relation does no longer exist; a relation between the anxiety level and the performance level was found, but not between the reaction time and performance, nor between the interaction of the two factors (anxiety and reaction time) and performance.

Finally, our findings suggest the importance of psychological monitoring of elite athletes and the necessity to include the tested variables in a psychological training program. The issue raised here is the one of the optimal and non-optimal areas of performance, whose content differ for every individual.

## References


Calvo, M., Alamo, L., & Ramos, P. (1990). Test anxiety, motor performance and learning: Attentional and somatic interference. *Personality and Individual Differences*, Volume 11 (1), 129-38.

Ciucurel, C. (2005). *Fiziologie*. Craiova: Editura Universitaria.

Collardeau, M., Brisswalter, J., & Audiffren, M. (2001). Effects of a prolonged run on simple reaction time of well-trained runners. *Perceptual and Motor Skills*, 93 (3), 679.

Davranche, K., Audiffren, M., & Denjean, A. (2006). A distributional analysis of the effect of physical exercise on a choice reaction time task. *Journal of Sports Sciences*, 24(3), 323-330.

Der, G., & Deary, I.J.(2006). Age and sex differences in reaction time in adulthood: Results from the United Kingdom health and lifestyle survey. *Psychology and Aging*, 21(1), 62-73.

Etnyre, B., & Kinugasa, T. (2002). Postcontraction influences on reaction time (motor control and learning). *Research Quaterly for Exercise and Sport*, 73 (3), 271-282.

Hackfort, D., & Spielberger, C.(1990). *Anxiety in Sports: An International Perspective*. New York: Taylor & Francis.

Hainaut, J.P., Monfort, V., & Bolmont, B. (2006). Trait-anxiety dependence of movement time performance in a bimodal choice task in subjects exposed to moderate anxiogenic conditions. *Neuroscience Letters*, Volume 409, Issue 3, 196-199.

Lenzenweger, M. F. (2001). Reaction time slowing during high-load, sustained-attention task performance in relation to psychometrically identified schizotypy. *Journal of Abnormal Psychology*, 110, 290-294.

Masanobu, A., & Choshi, K. (2006). Contingent muscular tension during a choice reaction task. *Perceptual and Motor Skills*, 102(3), 736-747.

Mullen, R., & Tattersall, A.(2005). The Effects of Anxiety on Motor Performance: A Test of the Conscious Processing Hypothesis. *Journal of Sport and Exercise Psychology*, Volume 27, Issue 2, June.

Nakamoto, H., & Mori, S.(2008). Sport-specific decision-making in a go/no go reaction task: difference among nonathletes and baseball and basketball players. *Perceptual and Motor Skills*, 106(1),163-171.

Neiss, R. (1988). Reconceptualizing arousal: Psychobiological states in motor performance. *Psychological Bulletin*, Vol 103(3), 345-366.

Panayiotou, G., & Vrana, S. R.(2004). The role of self-focus, task difficulty, task self-relevance, and evaluation anxiety in reaction time performance. *Motivation and Emotion*, 28(2), 171-196.

Robinson, M.C., & Tamir, M.(2005). Neuroticism as mental noise: a relation between neuroticism and reaction time standard deviations. *Journal of Personality and Social Psychology*, 89(1), 107-115.

Sanders, A. F.(1998). *Elements of Human Performance: Reaction Processes and Attention in Human Skill*. New Jersey: Lawrence Erlbaum Associates, Publishers.

Trimmel, M., & Poelzl, G. (2006). Impact of background noise on reaction time and brain DC potential changes of VDT-based spatial attention. *Ergonomics*, 49(2), 202-209.

van den Berg, J., & Neely, G. (2006). Performance on a simple reaction time task while sleep-deprived. *Perceptual and Motor Skills*, 102(2), 589-600.

Whelan, R. (2008). Effective analysis of reaction time data. *The Psychological Record*, 58(3), 475-483.