THE EFFECTS OF PHYSICAL EXERCISE ON STATE AND TRAIT ANXIETY

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Original scientific paper

Abstract

This study aimed to explore the relationship between physical exercise and anxiety, in particular between state and trait anxiety. A sample of 33 mid-level amateur athletes was taken into consideration and was compared with a control group of 17 sedentary subjects, through a psychometric questionnaire to detect anxiety levels: the STAI-Y. The outcomes did not show a significant correlation between sports practice and anxiety levels, in neither of the subscales. The purpose is to further analyze the relationship between the two variables to overcome the limits that the current research has found.

Keywords: *Physical exercise, sedentariness, trait anxiety, state anxiety, sport*

Introduction

Many research activities, in the field of social sciences and biology, have analyzed the benefits of physical activity on psycho-physical well-being. There are numerous scientific evidences showing how exercise decreases the risk of developing cardiovascular disease, osteoporosis and some forms of cancer, in addition to helping preventing obesity and diabetes (Warburton, Nicol, Bredin, 2006). Furthermore, physical exercise has significant effects on mental health (Stuart, 2016); in particular, the benefits of sport have been explored to counteract the development of states of anxiety (Anderson, Shivakumar, 2013) and depression (Craft, Perna, 2004). We can affirm that sport is an important moderating variable in the perception of individual well-being, the integrity of which depends on numerous factors of an environmental and personal nature, which, all together, determine our health state.

The aim of this study is to explore the relationship between physical activity and anxiety, a psychological construct capable of significantly altering our life quality, and consequently, our health. The term anxiety is widely used in the common jargon and can be defined as a psychophysical state characterized by a feeling of apprehension, uncertainty, fear and alarm with anticipation of ill-defined negative events, towards which the subject feels helpless and powerless (Torta, Caldera, 2008). It can be understood both as a feeling of nervousness, apprehension and agitation experienced at a given moment, and in this case we speak of "state anxiety", and as a stable characteristic of the personality, definable as "trait anxiety".

In this study, the effects of sports activity on state and trait anxiety levels measured through the administration of the STAI-Y test were investigated, compared to the hypothesis, widely highlighted in the literature, that sports favor the decrease in perceived levels of anxiety and improve life quality, through a comparison between the results obtained in the tests carried out by individuals who practice a sport with those obtained from tests carried out by subjects who lead a more sedentary lifestyle. In this regard, there are several studies in the literature highlighting the relationship between the incidence of mental health problems in too sedentary subjects (Rebar, Duncan, Short, Vandelanotte, 2014).

1_ Anxiety and its components

It is difficult to give a precise definition of anxiety for it is a very complex and generic concept, generally used to indicate an unpleasant psychophysical state of apprehension. Anxiety belongs to the sphere of affectivity and is an emotion that can have different intensities and causes; it is a physiological and psychological condition that is not abnormal in itself, but that can take on psychopathological connotations. Physiological anxiety plays a very important role for our survival, since it is a state of psychic alert with generalized activation of individual resources, aimed at a harmful, or potentially harmful, well-known and real stimulus. Normal anxiety is therefore an alarm reaction that not only does not interfere negatively, but, on the contrary, enhances the subject's operational capabilities in solving a situation.

Anxiety becomes pathological when such reactions are quantitatively exaggerated to the detriment of the performance level. All this was well documented in animals already in 1908 by Yerkes and Doson, who, on the basis of their experiments, developed the homonymous law (Yerkes, Dodson, 1908). The symptoms of anxiety can be classified according to:

1. duration
2. presence of triggering stimuli
3. presence of specific contents of the psycho-pathological phenomena.

Anxiety disorders are a very serious problem, which is often underestimated because of the difficulty in understanding when an anxious manifestation is part of a generalized discomfort with undefined forms, or if it falls within a psychopathological framework. Despite this, a large number of people make use of anxiolytic drugs, which are the most used drugs in Italy and in the world. This occurs mainly because the etiology-pathogenesis-symptomatology-therapy logical sequence generally used in medicine, hardly finds evidence in the field of psychological suffering like anxiety disorders, in which it is difficult to identify a clear etiology. In fact, these patients express (directly or indirectly, knowingly or not) a request for help, and psychiatric drugs are not always the most appropriate answer but are the most effective immediate response, and essentially, the most comfortable too. In fact, they should be used primarily as part of the full treatment, given their usefulness in reducing the pressure of certain symptoms, allowing the patient to more easily relate to himself, to the people around him, and therefore also to those to whom the request for help is addressed.

Anxiety disorders are the most common type of psychiatric pathology, with an incidence of 18.1% and a prevalence of a 28.8% over the course of life. However, only a 37% of patients with anxiety disorders undergo some form of health care. These data demonstrate how, in many subjects, anxiety is experienced more as a characteristic of one's own way of being, rather than pathology. Only when, in the continuum between normal and pathological anxiety, a threshold is exceeded, beyond which a functional limitation is manifested or a disabling impairment of the life quality, the request for therapeutic intervention becomes urgent. This clinical datum is subtended by a set of complex psychobiological aspects, which are closely linked to the therapeutic aspects. In addition, emotional symptoms are matched with neurovegetative symptoms, represented by increased sweating, tachycardia, muscle tension, increased blood pressure, tremors, tachypnea, mydriasis, disorders of the digestive and genitourinary systems, etc. Unlike fear, which represents an emotional response to a real threat, anxiety sometimes lacks the triggering cause, or this is not clearly recognized as such by the subject. However, this theoretical distinction is not always applicable: a really dangerous external situation can evoke instinctual impulses that generate anxiety. The latter, in fact, is a physiological manifestation, an innate mechanism that allows one to deal with a possible future danger, with adequate increased performance of vigilance, attention and with the implementation of a biological response of attack or flight: to this end, it can anticipate the perception of danger before it is clearly identified. The anxious state is susceptible to modifications that strictly depend on the subject's learning and experience level. Thus anxiety performs the function of adaptation to the environment, improving performance in emergency situations: in a first phase, therefore, the individual's performance improves as his anxiety level increased; however, if anxiety levels keep increasing, the performance response (whether it's physical, emotional or cognitive) decreases and becomes dysfunctional. Therefore, even if the fear response has evolutively a meaning of protection from potential dangers, this phenomenon can become disadaptive when unconditional stimuli induce apparently unmotivated reactions of anxiety and fear. In other words, the anxious condition becomes pathological when this mechanism of adaptation and protection becomes dysfunctional and anxiety produces an inadequate or unrealistic response to concerns about existence. In this case, instead of favoring the subject's adaptation to the environment, it makes it worst and makes therapeutic intervention necessary. Anxiety can be a symptom that is found in numerous disorders of psychiatric and medical order. In other cases, it becomes the predominant picture of the clinical context, resulting in the diagnosis of anxiety disorders. According to the DSM-V, anxiety disorders are divided into: panic disorder (PD), with and without agoraphobia, generalized anxiety disorder (GAD); social anxiety / social phobia disorder, specific phobia, selective mutism, separation anxiety disorder. Understanding the biological bases underlying fear, anxiety and related disorders, although not yet complete, is greatly advanced, thanks to the development of genetics, neurochemistry, psychophysiology and neuroimaging techniques. In particular, in the last decade, a significant increase concerning the knowledge of the neurobiological bases of anxiety is derived from the study of the behavioral components of the fear response, with particular regard to the notions concerning the underlying neuroanatomical pathways (amygdale, prefrontal cortex, thalamus and hippocampus), as well as the receptor and genetic aspects that can, at least in part, explain the different individual vulnerability to anxiety disorders (Stonerock, Hoffman, Smith, Blumenthal, 2015).

1.1_Neuronal circuits involved in anxiety modulation
As regards the neurobiological bases involved in the manifestation of anxiety states, it needs to underline the fundamental role played by the thalamus, which acts as the primary link between the extroceptive sensory systems (auditory, visual, somatosensory) that constitute the main afferences of the neuronal circuits determining anxiety and fear, and the primary sensory areas of the cerebral cortex that project sensory input to adjacent association areas, for integrated stimulus processing. The cortical association areas then send projections to various brain structures, such as the amygdale, the entorhinal cortex, the orbitofrontal cortex and the cingulate gyrus. The visceral afferences do not converge on the thalamus and activate the locus coeruleus and the amygdale, either through direct connections, or through pathways mediated by the paragigantocellular nucleus and by the solitary tract nucleus. Therefore, most of the information related to the stimuli that induce anxiety and fear is first elaborated in the sensory cortex (SC) and in the association areas, to

be transferred to the subcortical structures involved in affective, behavioral and somatic responses. The latter are triggered by the efferent pathways of the anxiety-fear circuit that cause an autonomic response, which involves the sympathetic and parasympathetic system.

The sympathetic activation, mediated by the HYP stimulation by the amygdale and he locus coeruleus, determines an increase in blood pressure and heart rate, sweating, piloerection and pupillary dilatation. The parasympathetic activation, the main projections of which are vagus and splanchnic nerves, mediated by the HYP, the paraventricular nucleus, the amygdale and the locus coeruleus, may be related to visceral symptoms associated with anxiety, such as gastrointestinal and genital-urinary disorders. Finally, the CNS directly and indirectly influences the immune system through complex neuroendocrine and neurotransmission interactions: the modulation of the immunosurveillance can, under certain conditions of intense and prolonged stress exposure, determine an organ or system meiopragia, up to the appearance of an organic disease. The evolution of molecular biology techniques has also allowed highlighting modifications in the expression of neuronal growth factors, in particular of the Brain Derived Neurotrophic Factor (BDNF), in the course of mood and anxiety disorders.

Finally, a large number of studies have explored with the help of neuroimaging techniques, the macro and micro-structural biomarkers of anxiety-related processes. Overall, what has clearly emerged from these studies is that the most important brain regions involved in anxiety-inducing behaviors are: the amygdale, the hippocampus, the orbitofrontal cortex (OFC) and the anterior cingulate cortex (ACC) (Blackmon et al. 2011; Baur et al., 2012; Kuhn et al., 2011; Spampinato et al., 2009; Liao et al., 2010; Fuentes et al., 2012; Barros-Loscertales et al., 2006; Cherbuin et al., 2008). Individual differences in anxiety symptoms may put some people at greater risk for developing psychopathology or neuropsychiatric disorders. Therefore, the study on neural correlates can help us understand the brain mechanisms underlying risk behaviors in both clinical and non-clinical populations. For example, a study carried out with the aid of neuroimaging techniques, through two different structural measurements, such as: voxel-based morphometry (VBM) (Ashburner and Friston 2005) and cortical thickness (Freesurfer) (Fischl and Dale 2000), explored the relationship between the STAI and HARS scales and the neural correlates underlying the manifestation of anxiety, with the aim of providing biological correlations for the two scales. Since these tests are widely used to assess anxiety in clinical and research domains, an unresolved question is whether these scales involve a similar psychopathological spectrum or they reflect different aspects of the anxiety phenomenon. This study showed that, despite a significant inter-correlation between the scores of the scales, the ACC was found to be the only brain region significantly associated with HARS scores. In contrast, the STAI scales did not show any significant relationship with brain regions underlying anxious behaviors. Thanks to these evidences it was hypothesized that the ACC plays a key role in emotional processing, acting as a generator of physiological or behavioral responses (Etkin et al., 2011) and, consequently, it is possible to find its involvement in anxious behaviors and anxiety disorders. In particular, functional studies which explored neural correlates of anxiety symptoms in healthy subjects showed abnormal ACC activation in subclinical anxious subjects during pain experience (Ochsner et al., 2006), and during the disappearance of conditioned fear (Sehlmeyer et al., 2011).

The lack of significant outcomes linked to the correlation between certain brain areas and STAI scores could depend on the fact that the test outcomes do not rigorously assess anxiety (Kennedy et al., 2001, Bados et al., 2010), but rather, they assess negative emotional states and personality traits that identify themselves as different dimensions of negative affectivity, including anxiety (Bieling et al., 1998). It could be hypothesized that the neurobiological correlates of the STAI scores are based on more widespread neuronal networks, outside the limbic circuits. Several neuroimaging studies also described a significant relationship between the morphology of the amygdale, OFC and ACC, and the increase in the values of the STAI scores (Blackmon et al., 2011 Baur et al., 2012 Kuhn et al., 2011; al., 2009). The only neuroimaging study that examined a large cohort of individuals (Montag et al., 2012) suggested that the relationship between anxiety and brain anatomy is critically influenced by gender, a critical variable not considered in previous studies mentioned above. This latest discovery aims to verify the hypothesis that the STAI scores are more influenced by gender rather than anatomical variability in limbic regions (Donzuso, Cerasa, Gioia, Caracciolo, Quattrone, 2014).

2_ Sport and physical activity

To understand how sport acts on the reduction of anxiety levels it is necessary to appropriately define its typologies and the relative action mechanisms on the organism, by starting, first of all, from the differentiation between physical activity and physical exercise. The first is defined as "bodily movement produced by the contraction of skeletal muscles that substantially increases energy expenditure" (United States Department of Health and Human Services, 1996). This term includes the full range of human movements, from competitive sports to hobbies or daily activities, (such as walking up and down stairs). On the other hand, physical inactivity can be described as "a state in which body movement is minimal and energy expenditure approaches the resting metabolic rate" (IARC 2002). Exercise is a subcategory of physical activity and is defined as "physical activity in which planned, structured and repetitive body movements are performed to improve or maintain one or more

components of the physical fitness" (Hardman & Stensel 2003). It is therefore a form of physical activity that is planned, structured, repetitive and performed with the aim of improving health or fitness but, although all exercise is a physical activity, not all physical activity is physical exercise.
We can distinguish three main types of physical exercise: aerobic, muscle strengthening and muscle increasing. The first type is also called resistance activity or cardio activity, and consists of the rhythmic movement of the large muscles for a prolonged period of time. Walking, running, cycling, jumping rope and swimming are all examples. Instead, muscle strengthening activities include resistance training and weightlifting, and aim at making the body's muscles work or resist an applied force or weight. The effects of muscle strengthening are limited to the muscles that do the work. Finally, bone strengthening activities (sometimes called loading or weight loading activities) consist of putting a certain amount of stress on the bones to promote bone growth and increase skeletal strength. Examples of bone strengthening activities include: running, walking, and weightlifting exercises. In addition, physical exercise can be further classified in terms of frequency, duration and intensity of the activity (Miles L, 2007).

The WHO, in its document "Global recommendations on Physical activity for Health" published the guidelines that define the levels of physical activity recommended for three age groups: young people group (5-17 years), adults group (18-64 years) and seniors group (65 years and over). To define the levels of physical activity recommended, the WHO chose the most easily measurable quantity, which is the time dedicated to it. This basic indication, which is insufficient in itself, has been supplemented by more precise indications on the type, frequency and intensity of the effort. For this reason, in this study, the time dedicated to sports activities was chosen as the ideal parameter to discriminate the participants belonging to the experimental group (composed of athletes of a medium-amateur level) and those belonging to the control group (individuals who do not practice sports activities).
In summary, the recommendations for age groups suggest the following:

• for children (5 - 17 years): at least 60 minutes a day of moderate-vigorous activity, including strength exercises that may consist of movement games or sports activities for at least 3 times a week
• for adults (18 - 64 years): at least 150 minutes per week of moderate activity or 75 of vigorous activity (or an equivalent combinations of the two) in sessions of at least 10 minutes at a time, with the strengthening of the major muscle groups to be performed at least 2 times a week
• for seniors (aged 65 and over): the indications are the same as for adults, with the warning to carry out activities aimed at balance to prevent falls. Those who are unable to fully follow the recommendations must exercise at least 3 times a week, and adopt an active lifestyle appropriate to their conditions.

3_ Sport and anxiety
There are several treatments, supported by scientific evidence, that have been effective for the reduction of anxiety, including cognitive-behavioral therapy (CBT) and psychotropic drugs, in particular, selective serotonin reuptake inhibitors (SSRIs). However, these treatments may be associated with significant drawbacks (such as the possibility of developing addiction and therapeutic barriers).
Physical exercise can be a promising and easily accessible treatment option for people with anxiety-related problems, whether they are clinically significant complications or not particularly severe discomfort, but that can compromise, at various levels, the life quality of the individuals who experience them.

With respect to the wide amount of research carried out on the positive effects of exercise in the treatment of depression, there is less literature on anxiety disorders. In general, aerobic exercise showed to be an effective and economic treatment, alternative or complementary to drug therapy for a variety of anxiety disorders. Several studies have indicated that aerobic exercise can be as effective as cognitive behavioral therapy in the treatment of generalized anxiety disorder. In addition, exercise at 70% -90% of the maximum heart rate for 20 minutes, carried out three times a week, showed to significantly reduce anxiety sensitivity. Despite this, a reduction in anxiety, comparable to the level reached by psychotropic drugs, is not documented. In a study on patients with moderate to severe panic disorder, a 10-week protocol of regular aerobic physical activity and clomipramine were both associated with significant improvement in symptoms compared to placebo. Compared with exercise, however, clomipramine improved anxiety symptoms more effectively and significantly (Snyder, Martinez, Bay et al., 2010).

A number of observational studies document an inverse association between physical exercise and anxiety symptoms. For example, in a study carried out on 8098 adults, people who exercised regularly shoed reduced risk of anxiety disorder compared to their sedentary counterparts. Although encouraging, observational studies data cannot demonstrate that exercise is able to reduce the risk of developing an anxiety disorder. Some studies on healthy individuals without anxiety disorders observed reduced state anxiety immediately after performing single periods of exercise (which could be a racing circuit). However, such studies did not address the issue of reducing anxiety levels after repeated exercise periods, nor were they aimed at those who have anxiety problems by clarifying whether these individuals could benefit from repeated periods of exercise or not . Depression can co-occur with anxiety, and many literature reviews related to research were made, which explored the usefulness of the exercise for treating depression.

In general, exercise seems to be effective in reducing anxious symptoms. In addition, the symptoms improve both after an acute physical activity episode and through a routine exercise program (Jayakody, Gunadasa, Hosker, 2014).
Future research will require a solid experimental design and increased attention to critical methodological details, including appropriate control groups, appropriate sample sizes and selection of validated tools to assess anxiety before and after the treatment.

4_STAI-Y
4.1_ Description of the instrument and of the analyzed dimensions (state anxiety and trait anxiety).

There are many tests for the measurement of anxiety and, in this study, the STAI-Y test was used, which is the only reagent that studies and compares the correlations between state and trait anxiety through two subscales (Y1 and Y2) (Julian, 2011). They consisted of 40 items (20 each) presented as statements that the subject must assess, in terms of intensity, how much these reflect his psychic state experienced at the time of the questionnaire administration (Y1-state anxiety) and habitually (Y2-trait anxiety). The interviewee had to evaluate the items on a Likert scale, through which the various statements were calculated according to their behavior. However, by means of the STAI-Y, it is possible to make a first discrimination between anxiety understood as a symptom, and anxiety expressed as a habitual way of responding to external stimuli (Lingiardi, 1991).

4.2_State and trait anxiety
The term anxiety is currently used to refer to at least two correlated but logically quite different constructs: state anxiety (S anxiety) and trait anxiety (T anxiety). The concepts of state and trait anxiety were introduced for the first time by Cattell (1966; Cattell & Scheier, 1961, 1963) and were developed by Spielberger (1966, 1972, 1976, 1979). In general, S anxiety refers to the concept of transient personality states that can be considered as transverse temporal sections in a person's life flow (Thorne, 1966), and the associated emotional reactions are the very expression of stable personality states (Spielberger, 1972). Specifically, anxious states are characterized by subjective feelings of tension, apprehension, nervousness and worry accompanied by a general hyperactivity of the autonomic nervous system. Although emotional states are transient, they can recur when evoked by appropriate stimuli, and can withstand over time when the evocative conditions persist. In contrast to the transitory nature of the emotional states, personality traits can be conceptualized as relatively lasting differences between people, based on the tendencies to perceive the world in a certain way, and as predispositions to react or behave in a specific way with predictable regularity. Personality traits have the characteristics of a class construct that Atkinson (1964) called "motivations", and that Campbell (1963) defined as "acquired behavioral positions". Atkinson defined motivations as dispositional tendencies, acquired during infancy, that are latent until they are activated by the signals of a given situation. T Anxiety refers to relatively stable individual differences in living anxious states, that is, to differences between people in the tendency to perceive a situation as stressful, dangerous or threatening, and to respond to such situations with increased state anxiety intensity. This type of anxiety may also reflect individual differences in the frequency and intensity with which anxiety states have manifested themselves in the past, and in the likelihood that state anxiety will be experienced in the future. In fact, the stronger the T anxiety, the more likely it will be for the individual to experience an increase in intensity in S anxiety in a threatening situation.

5_The experimental study
The study involved an experimental group consisting of 33 mid-level athletes and 17 individuals who do not practice any sport and lead a predominantly sedentary lifestyle. The age of the participants fell, for the most part, in a range between 18 - 28 years with out-range subjects that reached the lower threshold of 15 years and the upper threshold of 32 years. This age group was chosen as it represented the transition from adolescence to adulthood, in which the individual is forced to face important changes due to increased responsibilities, and consequently, daily worries. In fact, it is in this period that one begins to enter the world of work, and the study commitments increase for those who decide to undertake a university career. It is therefore easily understandable that, faced with all these tasks, the individual must learn to adapt flexibly to the new lifestyle, but if for some of them it is a step that does not involve particular concerns and takes place in an almost natural and painless way, for the majority of those belonging to the age group we are talking about, this period of changes involves a great load of stress and, consequently, it is very easy to experience anxious states of different intensities more or less frequently (Ferron, Narring, Cauderay, Michaud, 1999). In fact, the subjects belonging to the experimental sample came from different sports disciplines (karate, judo, artistic gymnastics, etc.) but share the weekly time (quantified in hours) dedicated to the sport, that is, at least 3 hours a week.

Moreover, this age group generally corresponds to the period of life in which sport can play an important role in managing stress, typical of this phase of growth. The interviewed subjects came from different sports disciplines, such as: artistic gymnastics, karate, judo, boxing, fitness and football. As for the differences based on the employment of the participants, a prevalence of university students was found.

5.1_Instruments
For detecting the anxiety levels of the two groups, the STAI-Y test described in paragraph 4 was used, which made it possible to differentiate anxiety in its two types (of state and trait type), and a form for

detecting personal data and levels of sport activity was employed.

6_Outcomes

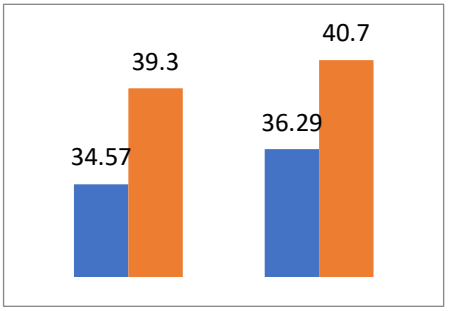
The analysis of the outcomes shows that the scores related to the anxiety levels obtained from the administration of the test to the experimental group and the control group provided higher values in the second sample, in both the state and trait subscales (Table 1-6).

This can be found in the total averages and in a greater dispersion from the average highlighted by the highest total standard deviations (Tab. 2-3). As for the inter-group differences related to the gender, it was observed that the male subjects of the experimental group obtained higher average scores, both in the subscale of state anxiety and in that of the trait anxiety, compared to the female subjects of the same sample. (Tab. 4); equally, in the control group, the male subjects obtained higher average values in both the subscales (Table 7). It was also observed that, in the experimental group, the standard deviation of the scores obtained from the subgroup of the male subjects was greater than the subgroup of the females, while the scores obtained by the female subjects in the state subscale showed a higher standard deviation compared to the male counterparts (Table 5). Instead, in the control group, higher standard deviation values were observed in the male subjects (Table 8). From the comparison between the scores obtained by the participants in the two subscales in each group, it can be observed that, in the experimental sample, the subgroup of the males obtained higher trait anxiety values and a lower standard deviation with respect to the state anxiety scores; instead, the female subgroup obtained higher stroke anxiety scores both in terms of average scores and of their related standard deviation (Table 1-6). The analysis of the outcomes, also in relation to the participants' gender, showed slightly higher average and standard deviation values in the subgroup of the males (Table 1-6). The analysis obtained through the t-test for independent samples showed that the differences between the outcomes of the two groups were not significant as regards the scores obtained at both subscales. (Tab. 9).

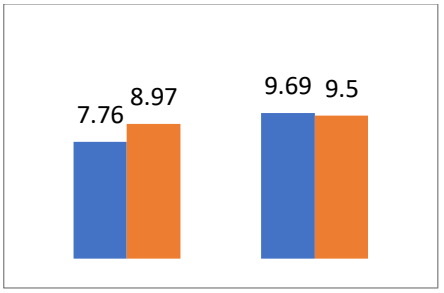
Tab. 1 – Groups average and standard deviation – experimental group

	State anxiety		**Trait anxiety**
	Male subjects (11)		Male subjects (11)
Average	38,36	Average	42,27
Standard deviation	10,13	Standard deviation	5,88
	Female subjects (22)		Female subjects (22)
Average	32,68	Average	37,86
Standard deviation	5,61	Standard deviation	9,96
Total Average	**34,57**	**Total average**	**39,3**
Total standard deviation	**7,76**	**Total standard deviation**	**8,97**

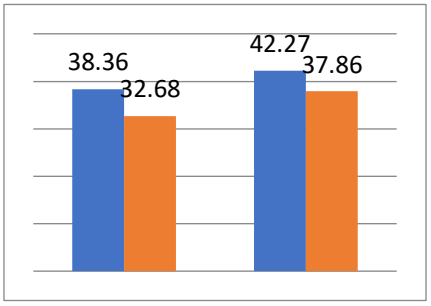
Tab. 2 – Comparison of the total averages of the two subscales between the groups



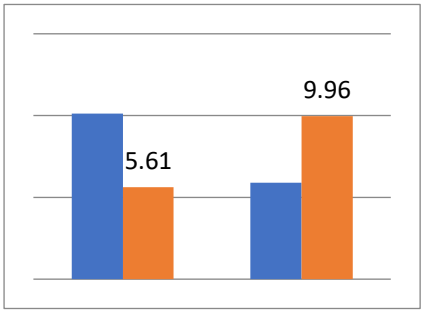
Tab. 3 – Comparison of the total standard deviations of the two subscales between the groups



Tab. 4 – Comparison of the avergaes of the two subscales based on the gender – experimental group



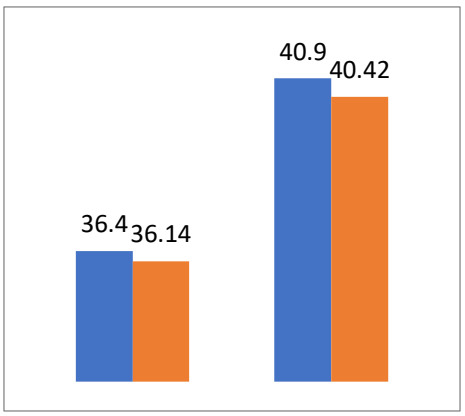
Tab. 5 - Comparison of the standard deviations of the two subscales based on the gender – experimental group



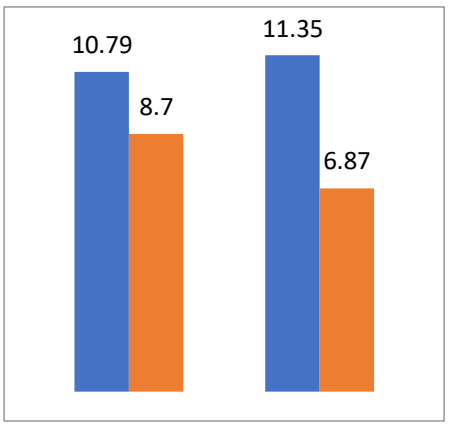
Tab. 6 – Groups Average and Standard deviation– control group

	State anxiety		Trait anxiety
	Male subjects (10)		Male subjects (10)
Average	36,40	Average	40,90
Standard deviation	10,79	Standard deviation	11,35
	Female subjects (7)		Female subjects (7)
Average	36,14	Average	40,42
Standard deviation	8,70	Standard deviation	6,87
Total average Total standard deviation	36,29 9,69	Total average Total standard deviation	40,7 9,50

Tab. 7 - Comparison of the averages values of the subscales based on the gender – control group



Tab. 8 – Comparison of the standard deviation values of the subscale based on the gender – control group



Tab. 9 - Significance

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Anxiety-state	Equal variances assumed	,133	,717	,681	48	,499
	Equal variances not assumed			,634	26,840	,532
Anxiety-tract	Equal variances assumed	,123	,728	,502	48	,618
	Equal variances not assumed			,493	30,810	,626

Discussion

The analysis of the outcomes does not show a significant correlation between a decrease in anxiety levels and the practice of a sports activity, because the test scores obtained from the two samples show state and trait anxiety levels in the control group that are only slightly lower than those of the experimental group. Therefore, the outcomes seem not to confirm the current stream of studies in the literature, relating to the evidence that underlines the role of physical exercise in the reduction of anxiety symptoms.

Furthermore, as regards the differential impact of sport on state and trait anxiety, the results show that trait anxiety is higher than state anxiety in the experimental and control groups. This data must be read in the light of the theory that sees the two types of anxiety with characteristics, in some respects, similar to the kinetic and potential energy. State anxiety, like kinetic energy, refers to a reaction or process that takes place at a given moment and with a certain level of intensity. Trait anxiety, like potential energy, refers to individual differences in reactions. The potential energy, in fact, refers to the differences in the amount of kinetic energy associated with a particular physical object, which can be released if triggered by an appropriate force. Trait anxiety implies differences in people's responses to stressful situations with varying amounts of state anxiety. The extent to which trait anxiety levels will differ from the corresponding levels of state anxiety depend on the extent to which each of them perceives a specific situation as dangerous or threatening, and it must always be kept in mind that this process is strongly influenced by the past experience lived by each individual. Individuals with higher trait anxiety levels, compared to individuals with low trait anxiety levels, often show higher state anxiety too, because they are more likely to interpret situations in everyday life as dangerous, threatening, and ultimately, as stressful. Moreover, these people generally also interpret a wider range of situations as harmful to their health. An explanatory example of this reasoning can be found in the fact that these individuals are also more likely to respond with greater increases in the intensity of state anxiety, in situations involving interpersonal relationships and threatening self-esteem. In such situations, state anxiety can vary in intensity and fluctuate over time depending on the amount of stress that affects the person, but the individual's perception of the threat can have a greater impact on the level of state

anxiety than the real danger associated with the situation (Bergua, Meillon, Potvin et al., 2012, American Psychological Association, Gorsuch, Lushene, Vagg, Jacobs, 2010).

Instead, a further datum concerns gender differences; males have higher values of both state and trait anxiety and this represents an interesting element to be analyzed in a possible future development of the present research, since there is no univocal opinion in literature concerning an estimate of differences in anxiety levels status and trait based on gender in a mid-level sports population.

The main limitation of the proposed study lies in the low number of the analyzed sample which prevents to analyze in an appropriate way a very articulated construct such as anxiety and in the heterogeneity of the sports practiced by the participants. In fact, a sample consisting of subjects who practice a lot of different sports and with few participants for each sports subgroup was considered. In this regard, there are several evidences in the literature that show how the different types of sports can have a different impact on the perceived levels of anxiety based on the type of activity and whether carried out individually or in a team (Pluhar E., McCracken C., Griffith K. L. et al., 2019; Tanguy, G., Sagui, E., Fabien, Z., et al., 2018).

Another aspect to be considered also lies in the type of instrument used, as the results obtained through the administration of STAI-Y with respect to trait anxiety (Y2), could also be indicative of a dysfunctional psychological state due to a sudden of depressive personality, since one of the limits of the instrument is precisely the difficulty in discriminating between anxiety and depressive traits. In this sense, it would be appropriate to add another test to the STAI-Y which allows more accurate measurements such as the HARS (Hamilton Anxiety Rating Scale) that is used to assess anxiety symptoms in a broad and generalized way (Bech 2011, 2012 ; de Bonis 1974) or the STICSA (State-Trait for Cognitive and Somatic Anxiety) that is a widely used measure of state and trait anxiety that permits a specific assessment of cognitive and somatic anxiety.

A final consideration concerns the impossibility of confirming the hypothesis concerning the observation of significantly lower levels of anxiety in the sporting population through the results of this study. In fact, although statistical support is not provided to support the initial hypothesis, it should also be taken into consideration that the experimental sample on which the study was conducted is composed by amateur athletes who play sport at different levels, while in the literature the main evidence of the effect of physical activity on the perception of anxiety comes from studies conducted on professional athletes. This last specification does not aim to discredit the foundations of the research presented but aims to highlight how a study conducted on subjects with a more ordinary level of sports preparation may be more representative of the general population and, in this sense, show more clear how different modes of physical activity can be useful to reduce the perceived anxiety in non-athletes, provided that the criteria of number and representativeness of the sample mentioned above are respected.

Conclusions

The research group intends to continue the survey by extending the sample, both in terms of the total number of participants, and in relation to the number of athletes for each sports discipline, in order to differentiate the anxiety levels for each category. Furthermore, the objective is to support the STAI-Y test with a further test for the more specific exploration of the overall anxiety level, such as the HARS or STICSA tests, in order to detect an additional variable to be compared with the levels of state and trait anxiety.

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Received: 07.04.2019.
Accepted: 06.10.2019.
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