BARÇA
INNOVATION HUB
Universitas

PSYCHOLOGICAL PREVENTION TECHNIQUES

INTERVENTION TECHNIQUES IN SPORTS PSYCHOLOGY II

4.1 Arousal and Relaxation Techniques

Introduction

During training and competitions, athletes experience diverse emotions. In recent years, sports psychologists have studied this phenomenon in athletes, along with the role of traditional training aimed at preparing athletes technically, tactically and physically.

Athletes are subject to very high pressure situations during their careers; it has always been this way. Throughout history, athletes have had to work hard in training and then perform optimally during competitions. The fact that sports psychology has gained prominence in recent years may be related to social changes: the evolution of training models (of higher and higher intensity); the range of training days (greater number of days and hours); the massive amount of media as a product of globalization (athletes are more exposed to the world); the rise of capitalism (the era of individual competition – grow as much as you can, otherwise you're nobody); demographic growth in every city (continually greater distances, more crowds, traffic, etc.); environmental pollution; the era of junk food and fast food (distortion of nutritional models). All of these variables can lead to increased levels of stress and anxiety in athletes, which in turn has led to growth in different branches of psychology that study these variables with the objective of maintaining athletic performance. At the highest levels of competition, we can say that the technical, tactical, and physical abilities of athletes are well balanced. Consequently, the focus is on strengthening the mind (since we are referring to psychological variables) as a distinctive variable for athletes.

Arousal, anxiety, and stress are the most studied variables in the field of sports psychology. These variables are related to aspects of human personality, and behavioral sciences are involved in studying them in order to better understand how to find possible solutions.

In this unit, we will focus on the terms arousal and relaxation with the intention of providing a theoretical framework with tools for a later practical application.

The coaches and the team of psychologists are responsible for educating athletes and parents about the importance of focusing on these variables. Sports managers are often business people who see sports as a market to exploit economically. In reality, sport is made up of athletes who may need support to work on psychological variables, in order to prevent these variables from negatively impacting sports performance. If we're talking about the start of a sports career, we sometimes find that parents have high expectations for the sports career of their children, and this can generate high anxiety levels for children, due to a fear of failing or disappointing their parents. These are some possible reasons why athlete feels pressured and/or stressed.

We will now discuss the concepts of arousal and relaxation.

4.1.1 Arousal

Before focusing on strictly sports-related topics, we need to understand what gives rise to arousal in order to create a base from which to better understand the topic.
Arousal is a physical occurrence connected to increased heart rate, blood pressure, breathing, metabolism and other biological indicators.

Neurophysiology of Arousal

Arousal is controlled by the superior structures of the central nervous system. The structures linked to arousal responses in human beings are the cerebral cortex and the hypothalamus, along with the ascending reticular activating system in the brain stem (between the brain and the spinal cord). A brief description of each structure and how it relates to arousal follows.

Cerebral Cortex

In the cerebral cortex, there are 50-80 million neurons, which are divided between the frontal, parietal, occipital, and temporal lobes. The electrical activity of the cortex can be measured by an electroencephalogram (EEG). This instrument detects changes in electric potential within the brain. For

example: states of arousal in people are related to synchronous, rapid, and low-amplitude (electroencephalographic) waves of activity. On the other hand, low states of arousal are characterized by asynchronous waves.

Hypothalamus

Despite representing just 1% of brain mass, the hypothalamus controls emotions and arousal. Arousal of the lateral hypothalamus stimulates arousal and generates anger. In contrast, stimulation in other areas of the hypothalamus generates responses of decreased arousal and calm.

Ascending Reticular Activating System (ARAS)

This system is related to arousal when people feel threatened. This triggers a sequence of neurological events that bring about the arousal response.

Below, we will present some of the physiological indicators of arousal in human beings, which can be observed by coaches studying arousal levels in athletes.
Arousal indicators:

- Electrical activity in the brain: only observable through an electroencephalogram.
- Biochemical indicators: adrenaline and noradrenaline levels can be measured in the blood.
- Heart rate: can be measured indirectly through the pulse.
- Muscle tension: muscle tension levels are related to arousal levels.
- Breathing rate: can be measured with a spirometer, and is a reliable indicator of arousal levels.
- Palm perspiration: increased activity of the sweat glands in threatening situations.

These are some of the indicators of individual's arousal levels. Some of these can only be observed through very specific medical devices, but others (like heart rate, muscle tension, breathing rate, and perspiration) are directly observable by the athletes themselves and their coaches.

The objective of the coaches is to have athletes with optimal arousal levels, since elevated levels are related to states of activity where athletes have reduced precision due to the body's state of alertness.

4.1.2 Arousal Concepts

Sports psychology considers that all manifestations of behavior must be stimulated by an energy source that generates said behavior.

Arousal is the body's physiological and psychological response and it varies across many states, from complete rest to extreme excitement.

Arousal is related to dynamic and energetic behaviors. Some coaches use the term "activation" to refer to arousal.

Authors like Pozo, Cortez, and Martin-Pastor (2013) consider that arousal in athletes is a state of the body that is mediated by cognitive, emotional, and attentional functions. In the sports context, the subject evaluates the environment surrounding them based on their repertoire of motor skills and previous experiences, managing possible emotional reactions and arousal levels. These two variables, emotion and arousal, are closely related, and some authors use them interchangeably.
Hanin, (2000):

> "The zone principle implies a specific relationship between the perceived intensity of optimal or dysfunctional emotional states and performance."

Birrer and Morgan (2010) suggest that athletes must understand the quality of their own motor skills in terms of carrying out actions. They must also understand in what situations they reach optimal arousal levels, as well as what the appropriate level is for each moment. For this, athletes need to be able to evaluate their arousal levels by observing their own body and they must have strategies for regulating them.

Optimal Arousal Levels

There are different levels of optimal arousal for different moments; it is also known that particular arousal levels correspond to each sport. The moment before completing a gymnastics maneuver and running a 100-meter sprint are not the same. Each sport and each moment is different. Birrer and Morgan (2010) state that the optimal activation level for each sport is not even known from a theoretical standpoint. The individual characteristics of

each subject would need to be considered, since there is no standard that works for the entire population.

It should be noted that athletes must be mature enough and have enough experience so they're able to understand how to manage their arousal levels during athletic competitions. In addition, cognitive psychology interventions for training this type of ability should be applied just when the athletes' maturation levels are suitable for the work they want to do. Some authors suggest that the time to intervene at a cognitive level is between 15-17 years (Reeves, Nicholls, & McKenna, 2009), although we must keep in mind that professional sport is starting younger and younger nowadays.

As a result, it is clear that, during trainings and competitions, athletes experience a series of emotions, which they must control to avoid harming their athletic performance. In this case, it isn't a matter of training athletes not to experience arousal or emotions; rather, it's a matter of providing them the resources to manage their arousal levels and, consequently, manage their emotions through psychological techniques.

For example, if a soccer player is going to execute a penalty shot and their arousal level is very high (because scoring that goal means winning a match or a final, or even because their standard for themselves or their fear of failure is high), they will likely miss the shot. However, if the athlete is able to identify that their arousal is very elevated (by an increased heart or breathing rate, for example) they will be able to put mechanisms into practice to reduce their arousal (through breathing exercises or visualization they have previously trained with) to concentrate on the action to be completed.

4.1.3 Arousal and Athletic Performance

Activation is associated with the term "arousal," which is understood to be the natural state of activation and means "an increase in attention." In the sports field, the terms arousal, stress, and anxiety are used interchangeably; however, there are variables that differentiate them. Arousal uses with the body's resources in situations where the athlete has to confront activities that involve a physical and cognitive load.

Athletes with low levels of arousal are relaxed; their reflexes are diminished; and their minds are deactivated. In contrast, high levels of arousal are

related to an increase in the physiological and psychological variables described above. Arousal is considered to be an ideal state of activation. Therefore, arousal adjusts and regulates activation levels at all times, establishing an optimal parameter.

To work on optimal arousal levels with athletes and to assist the information exchange between coach and athlete, we can utilize an arousal register created by the coach, giving the arousal level a scale from 1 to 10.

For example: in a track and field training session, the coach prepares an exercise where the athlete has to finish 2 blocks of 4 series of 100 meters. They rest for 3 minutes between each series and 7 minutes between blocks, completing the 100 meters in 13 seconds at 80% of their capacity (arousal level 8 out of 10).

Once the training has been completed, the athlete will evaluate what arousal level they were at when completing that exercise (from 0 to 10), and whether they achieved the desired time. They will also evaluate the feelings they experienced (if they felt comfortable or, on the other hand, if they struggled to reach the goal time indicated, having to give 100% instead of the 80% asked of them, etc.). The coach, on their part, will evaluate how they see the athlete based on the execution of the exercise and the time obtained.

The arousal level can be guided by the coach (like in the example) or they can just indicate a goal to achieve (complete the exercise in a certain time, with the athlete assessing the arousal level needed to achieve it), or no indication may be given.

This type of register not only favors the athletes' self-knowledge about their optimal arousal level to achieve desired results; it also favors communication with the coach to adapt training individually to achieve the goals of each athlete. When instruction is given about the requested arousal level for the specific exercise, the goal to achieve in that task is also indicated.

High-level athletes who know their arousal and emotional levels well will be able to complete an assessment of their arousal level for their training in general. However, in lower level sports, it is better to evaluate the exercises individually until the athletes get to know themselves.

4.1.4 Relaxation

Defining the concept of relaxation is a complex task, since the term is used in multiple disciplines, and it pursues different objectives in each one. According to the field or the period where the term "relaxation" is being defined, different focuses and applications will be found. For example: the spiritual or psychological domain.

Relaxation has a direct relationship with muscle tone, as understood in terms of psychology and psychomotricity. The ability to relax can be associated with self-control or, as some authors propose, the development of personality, self-awareness, and self-discovery.

From a spiritual perspective, relaxation is understood as the existential unity of being, or the feeling of profound silence. The origins of relaxation from its first applications are found in the East through yoga (3000 B.C.). In the sports field, it can be said that martial arts from Japan and China are the pioneers in making relaxation central to their discipline. The Western view of relaxation brings the analysis to a more mental level, and leaves aside the spiritual focus of the term. Thus, we begin to understand its application in people's lives from a scientific viewpoint and how influences quality of life.

As a side note, in the ancient East, the terms "stress" and "anxiety" do not actually exist. In the West, the use of these variables began to be used as a product of the culture, rhythm, and philosophy of life. It can be said that relaxation in the East is part of life; while in the West, it is necessary for life.

Theories and Models of Arousal and Relaxation

Arousal

Below, the models that relate arousal with athletic performance are presented, specifically drive theory, Inverted U Theory, catastrophe theory and the optimal functioning model.

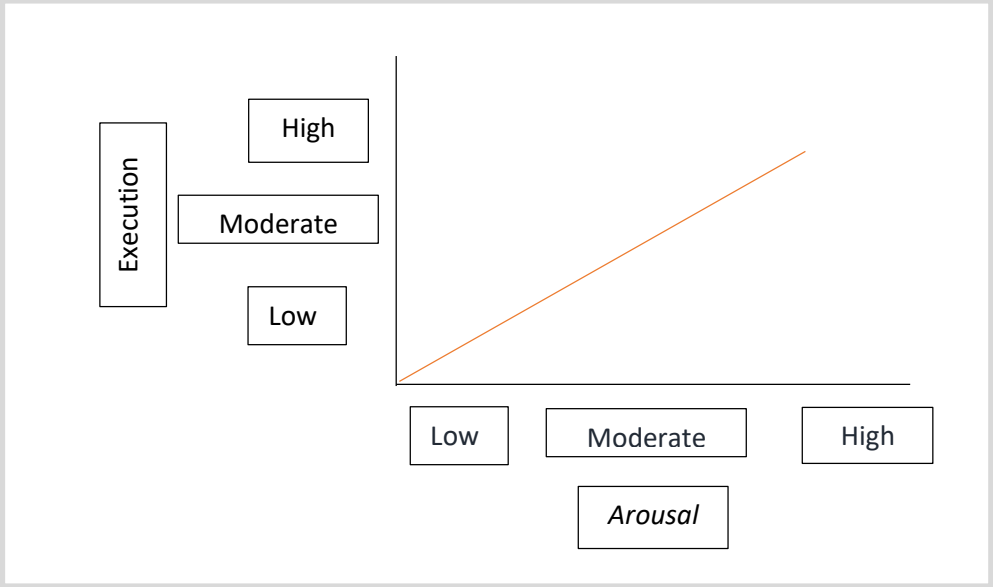
Drive theory:

Arousal levels are related to the improvement of abilities. In so far as the athlete makes mistakes and commits errors, the response that will dominate motor execution is incorrect, and vice versa. When fewer errors are made, the dominant response is correct. Arousal is proportional to motor learning: in so far as the execution is controlled, arousal improves.

Drive theory is based on the following formula:

- Performance = arousal x ability level.

Figure 1: Drive theory



Source: Prepared by the author.

This is a psychological perspective, applied in the past, and suggests a linear relationship between arousal and athletic performance. It has a one-dimensional nature because it considers arousal as the only variable that influences athletic performance. Poor athletic performance is attributed to elevated arousal levels. Today, we know that the relationship is not that simple. Rather, there are multiple variables, and there are athletes who achieve superior athletic performance under high arousal levels.

The basic principles of drive theory are:

- An increase in arousal generates a dominant response.
- When starting an activity or during the learning process, the dominant response is incorrect.
- For exercises with low difficulty and simple learning processes, the dominant response is correct.

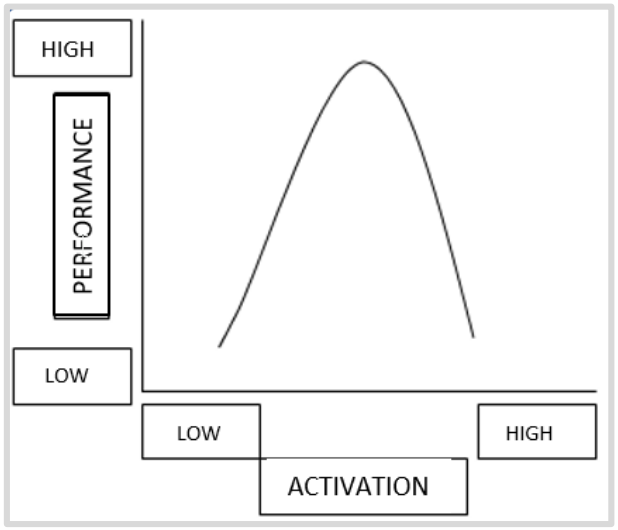
This theory considers that high levels of arousal work in favor of athletes with more experience and against inexperienced athletes.

Inverted U Model

This theory is also one-dimensional, since it relates anxiety directly with athletic performance - associated with the physiological variable and not the cognitive variable. In this case, the relationship attributed to arousal and athletic performance is curvilinear. In this theory, optimal arousal levels can vary with respect to the complexity of the task. Elevated arousal levels worsen the execution of complex tasks and favor simple tasks. Everyone has an optimal arousal level. Before or after this optimal point, performance lowers; that is, when arousal is too high, performance tends to decrease.

Following this model, a tennis player with a low level of arousal during a competition will make more mistakes because their attentional field is too elevated, and they are distracted by the public, the opponent, or other non-relevant external stimuli. As a result they are unable to focus on the stimuli they need to pay attention to during the match (for example, their opponent's movements), hindering their selective attention. If, on the other hand, their arousal is too high, they will miss easy shots that they would not normally miss in an optimal arousal state, because their technique will be affected by their increased heart rate and anticipation in the game. For that reason, it is important that each athlete finds their optimal arousal level and trains in techniques for regulating arousal levels, thus differentiating themselves from their opponents.

Figure 2: Inverted U Theory



Source: Prepared by the author.

Catastrophe Model

In this model, the relationship with performance is determined on the basis of physiological and cognitive variables. Therefore, both variables determine optimal arousal levels.

The variables involved in the arousal level can be regulated by the athletes to find their exact optimal arousal level, or optimal zone. The point is to find the optimal level each person needs and find strategies to reach it.

The catastrophe theory considers that when athletes face levels of stress and arousal during a task, their performance level decreases drastically to catastrophic levels – hence, the name. This sudden decrease in athletic performance is not considered in the Inverted U Theory. When experiencing very high levels of stress, an athlete may be unable to complete an action despite it being automatic (not taking the regulated steps in a triple jump, stepping with the ball, etc.). The athlete experiences a mental block that may leave them paralyzed or makes their actions completely wrong or rushed.

Optimal Functioning Theory

This theory is part of the principle of specificity, which postulates that optimal arousal levels vary according to each athlete. It is believed that determining anxiety levels in an athlete before a competition will allow them

to control their arousal levels. These levels are not only measured in competition; rather, the work is begun during each training session to efficiently transfer this skill to competition later on. Thus, it is recommended that the training sessions have similar conditions to the competition itself (people in the stands, ambient noise, high level of competition, "unfair" refereeing, maximum effort). This will make it easier for the athlete to assess and regulate themselves in cases of too little or too much arousal, and it will allow the coach to recognize symptoms that their athletes exhibit in situations of low or high arousal (sluggishness, rushing, rapid breathing, nervousness) in order to regulate them.

According to Raglin and Hanin (2000), an athlete's anxiety level should be monitored and known prior to the competition in order to start with adequate arousal levels. This theory explains the relationship between anxiety and athletic performance.

Relaxation

With regards to relaxation models and theories, the **ABC (Attention Behavioral Cognitive) Relaxation Theory** was proposed by Smith (1999). It defines relaxation as an act of simple, continuous, and steady concentration and focus. It involves maintaining concentration on a simple stimulus.

Smith (1999) identified ten psychological states related to relaxation, which he divided into two levels referred to as R-states. The first corresponds to immediate stress reduction:

- Drowsiness.
- Disconnection.
- Physical relaxation.
- Mental relaxation.

The second level corresponds to deeper relaxation where the positive state consists of openness, awareness, and energy:

- Awareness.
- Joy.
- Mental silence.
- Love and gratitude.
- Dedication.

- Energy.

These states contribute to maintaining continuous relaxation levels, where the subject-athlete maintains a positive attitude when coping with certain stressful situations.

Now that we have reviewed the models and theories that support and sustain arousal and relaxation variables, we can look at different techniques that can be used to work on those variables.

Techniques for Controlling Arousal

Biofeedback:

Human beings have the capacity to voluntarily control their autonomous nervous system. That principle supports this technique (Tenenbaum, Corbett, & Kitsantas, 2002).

Anxiety and tension levels can be managed by controlling functions of the sympathetic nervous system. With the help of an instrument, the subject is able to manipulate some physiological variables. For example, the athlete learns to control their heart rate in a lab, later translating this knowledge to competition. This is one of the issues with the technique: to begin training physiological variables, instrumentation should be available, and such instruments can be costly.

The most utilized techniques in biofeedback training are the following:

- Skin Temperature: when the subject is activated, blood goes to the vital organs. In this case, the palms feel cold and clammy. Temperature can be measured with a thermometer. Thus, the athlete can identify the moments in which stress is experienced and use techniques to reduce arousal.
- Electromyography: the electromyograph machine (EMG) measures muscle tension through electrodes. The subject tries to reduce tension with auditory or visual information about the electrical activity in their muscles.
- Electroencephalogram: in this case, it is used to train brainwaves. Beta waves dominate during periods of arousal and excitation, while

Alpha waves dominate when the subject is relaxed. The subject can try to generate one or the other to control their levels of arousal.

Success or failure between two athletes with similar characteristics lies in whether or not they know how to control their arousal and anxiety levels.

In cases where clubs or institutions can access this type of equipment, this methodology can be repeated to learn arousal levels and work on techniques to control them. They are not the most ecological of measurements, since they cannot be put into the context of each sport, but they do provide access to objective data. Similarly, we can also work with the techniques below, which have a much lower cost.

Techniques for Controlling Relaxation:

Progressive Muscle Relaxation:

Jacobson (1938) hypothesized that it is impossible to be tense when your muscles are completely relaxed, and that an anxious mind cannot connect with a relaxed body.

The method of this technique requires that the subject finds a quiet place, and that they lie on their back with their arms at their sides. The subject tenses a muscle and then relaxes it. Thus, the athlete begins to differentiate between relaxation and tension. With progressive training, the subject will be able to relax a muscle without tensing it previously. The author proposes that the first minutes of training sessions should be reserved for muscle tensions. Only then will the athletes be relaxed.

The order of the work is predetermined: begin with the left arm, then the right; the left leg, then the right; then the abdomen, back, chest, and shoulders, finishing with the neck and face. 15-minute sessions are recommended during the first few months, for at least 40 sessions.

Here is an example of how to guide a Progressive Muscle Relaxation session: In a room with low light, with a calm and quiet environment and a pleasant temperature, ask the athletes to be seated or stretched out (whichever is most comfortable for them to relax their bodies) and close their eyes. Calm music (at a low volume) can be used to help achieve a state of relaxation.

Relaxation has three phases:

First Phase: Tension-Relaxation.

With a clear and calm voice, ask the athletes to contract the muscles in their faces, necks, and shoulders:

- Frown the forehead for five seconds. Then, relax the forehead slowly. Repeat three times.
- Close the eyelids tightly for five seconds, and relax them slowly. Repeat three times.
- Wrinkle the nose for five seconds, and relax the muscles slowly. Repeat three times.
- Smile widely for five seconds, and relax the muscles. Repeat three times.
- Press the tongue against the roof of the mouth for five seconds, and relax it slowly. Repeat three times.
- Grit the teeth together for five seconds, noting the tension in the lateral muscles of the face and temples, and relax. Repeat three times.
- Purse the lips like giving a kiss for five seconds, and relax. Repeat three times.
- Bend the neck back, and return to the initial position. Then, bend it forward, and return to the initial position again slowly.
- Raise the shoulders, pressing them against the neck. Hold for five seconds and relax, returning to the initial position slowly.

This same tension and relaxation process will be completed with the rest of the muscle groups in the order indicated below:

1. Face, neck, and shoulders: explained in the previous example.
2. Arms and hands: Arms, forearms, and fists (each arm is done separately).
3. Legs: buttocks, quadriceps, knees, calves, and feet (first one leg, then the other).
4. Thorax, abdomen, and lumbar region (this part of the relaxation is more easily done seated in a chair, but it can be continued laying down so as not to interrupt the relaxation).

To complete this part of the relaxation, we can give the following instructions:

- To tense the back, we will cross our arms over our chests and lift our elbows backward, noticing the tension in our shoulders and lower back. Relax.
- Take a deep breath and hold the air in our lungs for five seconds while we observe the tension in our chests. Exhale the air slowly.
- Tense the abdomen for five seconds, and relax the muscles.
- Tense the buttocks and quadriceps at the same time for five seconds, and relax.

Second Phase: Review.

1. Complete a mental review of all the muscle groups that we have tensed and relaxed. Verify that all the muscles are still relaxed and try to relax them even more.
2. We will frequently note that muscles like the forehead, jaw, or fists are slightly tense. In this phase, we become aware of the tension that we exert on our muscles involuntarily, and we practice relaxing them without needing to complete the tension-relaxation exercise, as we would do during a competition.

Third Phase: Mental Relaxation:

The athlete should think about something pleasant. It can be an image, situation, or something that relaxes them: a place, music, or keeping the mind blank.

Autogenic Training

This is based on feelings associated with the limbs and muscles. This training is composed of three parts. The first consists of six steps to convey to the mind a feeling of heaviness in the arms and heat in the body:

- Heaviness in the arms and legs.
- Heat in the arms and legs.
- Heat in the chest and feeling of the heart rate lowering.
- Heat in the solar plexus area.
- Cool feeling in the forehead.

To complete this exercise, the athlete should be seated in a chair with a relaxed position, letting the forearms rest on the legs, which are slightly separated. Like in guided relaxation, the environment should be as calm as

possible, that is to say, with no outside noise, dim lighting, and a pleasant temperature.

Here is an example of how to guide autogenic training for heaviness in the arms:

1. Sit in a comfortable position and try to relax. Remember to breathe normally during the entire exercise.
2. Close your eyes and concentrate on your right arm.
3. Repeat in your head, “my right arm is heavy, my right arm is getting heavier and heavier”.
4. Repeat this phrase in your head six times.
5. When you feel like your right arm is really heavy, repeat in your head, “I am completely calm”.
6. Repeat this phrase in your head three times.
7. To complete the exercise, breathe deeply, stretch your extremities, and open your eyes slowly.

The second step is to use your imagination. While the subject imagines relaxing moments or scenes, they feel heaviness and heat in their bodies. These occur simultaneously: the feeling and the imagined moment/scene.

The third step consists of using specific topics that produce relaxation responses (Davis et al., 1995). This step is about giving instructions to the mind so that the body relaxes.

This training requires several days of practice to perfect. In fact, it is recommended that the exercise is initially practiced three times a day, lasting no more than five minutes (starting with only one limb). Once mastered, it will be lengthened to 20 minutes per session (adding the rest of the limbs).

Practicing this type of training requires a long period of preparation before arriving at the third step. It is common to reach an optimal state of relaxation after the first two exercises, and the athlete won’t need to advance to the third step to achieve their goal.

Transcendental Meditation:

This technique is a branch of traditional meditation. In this case, repeating a **mantra** is used to guide the meditation. This is a sound used by the instructor which aids concentration. The most popular sounds are "om" and "aum". Additionally, mandalas, which represent geometric figures, and *pranayama*, which uses breathing as a mental control strategy, can be used.

The practical application consists in placing the athlete in a comfortable position with their eyes closed while they concentrate on their breathing and repeat the mantra. These techniques are known to decrease levels of anxiety and stress, but how much it improves athletic performance has not been confirmed.

Coaches and sports psychologists must find tools that allow athletes to reduce their anxiety levels and keep their arousal within the necessary limits for athletic execution.

All the methods explained in the unit pursue that intention, with tools for practical application that can be utilized in training.

Characteristics of Breathing Exercises

The breathing sequence is: inhale, pause, exhale, pause. Each sequence is repeated ten times and the type and depth of breath, whether it is nasal or oral, should be kept in mind.

Types of breathing:

- Deep breathing: place the left hand on the abdomen and the right hand on top of the left hand. Breathe for three to five seconds, imagining that a bag inside your abdomen is being filled. Mentally repeat: "My body is relaxed".
- Controlled rhythmic breathing: a diaphragmatic breath while trying to be conscious of the air in your airways. Find your pulse and breathe in sync with its rhythm. Try to make each breathing cycle span 5-6 beats, for example.
- Counted breathing: try to think of a (single syllable) word assigned for inhaling, and another for exhaling.

Relaxation techniques, just like athletic skills, are resources that are learned with practice. By training in relaxation, habits can be changed. Once an athlete masters this technique, they can utilize it during competition to lower their heart rate or breathing rate, thus adjusting their arousal level for the task to be completed.

It is recommended to begin with 30-40 minutes of daily practice for the first few weeks. As they progress, the trainings are used two or three times a week. By utilizing this resource, it is possible to manage the situation – the objective of every athlete.