RESPIRATORY ENDURANCE, PULMONARY DRUGS AND SPORT PERFORMANCE: AN ANALYSIS IN A SAMPLE OF AMATEUR SOCCER ATHLETES

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Abstract
Introduction: Different drugs and several respiratory drugs have been used to enhance sporting performances. Some of them are included in the list of prohibited substances if not they are administered by inhalation. Moreover many respiratory drugs are permitted by the International Olympic Committee (IOC) but, in certain cases, they need to be accompanied by a written notification. Aim: We aimed to investigate the relationships between respiratory structuring and proper functioning, and the development of respiratory resistance without use of respiratory drugs in a group of twenty senior male soccer amateur football league players. At the athletes (age 41.2 ± 3.1 years), with different education levels to the sports performance factors (technical, tactical, physical and psychological) and to the training contents, were administered respiratory tests (spirometry, motor tests, cooper tests). Methods: They are distributed into two groups (A control and B with lowest indexes), and verified attendance at scheduled, weekly and supplemental training sessions for six months. The data processed allowed to calculate the VO2max in consideration of the characteristics of mixed energy expenditure of the football discipline. Results: 65% of the team has shown an inadequate performance, related to the ability to resist, as many athletes have not completed the 12-minute course. At the group B athletes, supplemental training program was proposed; three athletes (41 years) who returned from injury and prolonged inactivity showed non-positive returns, comparable to others of athletes with an average age of more than 45 years. Improvements were detected in both groups. Group A recorded a performance increase of about 18-20% while group B of over about 25% with indexes, in some cases, close to about 30%.

Key words: *soccer, respiratory drugs, endurance, performance, VO2max.*

Introduction

Sports performance training improves functional movement to support the physical demands of sport and help athletes of all levels shore up weaknesses, decrease injury risk, and build strength and power (Mazzeo, 2016a; Schenone et al. 2003). The current literature concerning the effects of respiratory and some drugs on the respiratory system and on the respiratory controllers of the respiratory muscles (Mazzeo & Liccardo, 2019). Coaches and athletes spend a great deal of time thinking about how you can improve, or trying to understand the elements that make up a good performance (Mazzeo et al., 2016; Mazzeo & Volpe 2016). Sports performance, at both the elite and participatory levels, requires the coordinated efforts of athletes, coaches, scientists and other professionals (Mazzeo, et al 2019).

Therefore, the performances (Ferraz et al., 2017) of the athletes are variable in relation to the regulations of the specific disciplines, the psychophysical characteristics and the skills and motor skills of the individual and / or team as well as the training methodology developed (Mazzeo, 2019). The athlete performs complex actions programmed during training sessions (Clemente-Suárez et al., 2018; Montesano et al, 2013) which, often, are not repeated with the same intensity in competitive contexts due to the incidence of variables (Vahia et al., 2018) not controlled.

Resistance, conditional motor skills, connotes the athlete who shows a constant performance throughout the race (Chtourou, Souissi, 2012; Montesano & Mazzeo, 2018) if he has developed the ability to sustain workloads through specific training that adequately develop the respiratory capacity. The improvement in resistance is closely related to the functionality of the cardiocirculatory apparatus (Myllymäki et al., 2011) and respiratory system, which provide the energy to sustain a prolonged aerobic and anaerobic effort, and with the amount of red fibers present in the muscles. Whether or not pharmacological interventions can improve the respiratory system (Mazzeo & Raiola, 2018). The maximum increase of this conditional capacity is therefore possible, through specific training, only when the large systems are completely developed, ie from 12-13 years. Strength training leads to significant benefits but it is important to pay attention, however, to overtraining, or overtraining (Montesano et al., 2019), which can negatively affect speed, explosive strength (Huang et al., 2009). and therefore on global performance (Montesano, 2018, Montesano et al, 2013). The player is an athlete who requires a bioenergetic type of alternate, anaerobic-aerobic (Cipryan, & Gajda, 2011), with the administration of training sessions (Montesano & Tafuri, 2017) of a specific type or mixed type after the morphofunctional classification and assessment, through tests, of motor, coordination and conditional skills. Multiple factors may affect the sports performance of the player, exogenous factors such as climate and field conditions, and endogenous, psychophysical factors such as workload, overtraining, nutrition (Di Onofrio et al., 2019) and stress condition (Nédélec et al., 2015, Mazzeo, 2016b) .

During the competitions and training sessions (Suarez-Arrones et al., 2018) the metabolic processes are activated (Ferrara, Goldberg, Ortmeyer, Ryan, 2006) aerobic (continuous run and / or with variations in speed); anaerobic alactacid (horizontal and vertical jumps, speed, speed); anaerobic lactic acid (sprint with short recoveries); alternating aerobic-anaerobic (technical-tactical exercises and competitions). In terms of classification, resistance capacity is diversified in general and specific. The general resistance provides the possibility of prolonging a moderate / medium intensity muscular work, the specification allows to sustain a more intense work while keeping the performance constant. In both cases the onset of fatigue, caused by the accumulation of lactic acid in the muscles and blood, prevents the continuation of the work itself. Moderate work results in a modest increase in lactic acid, the incidence of which is compensated by the normal supply of oxygen, while intense work does not allow the normal flow of oxygen to make adequate compensation. The increase in resistance, favors the possibility of sustaining more and more significant workloads. Protracting them over time by exploiting the flexibility of the respiratory system, which allows a much greater range of activities to be carried out (Buehler, 2013) compared to the simple transfer of oxygen from the external air to the blood and the removal of the carbon dioxide (Amann, et al.,2008).

The importance of respiratory muscle efficiency emerges, which significantly affects the link between respiratory fitness and the ability to exercise the entire organism .

During exercise the body increases the demand for oxygen (Howley, Bassett, Welch, 1995) and our volume of breathing or ventilation, this requires many muscles to contract in a highly coordinated way. In the development of resistance, in sports with mixed characteristics, the athlete is required to breathe with an increased volume of ventilation for a prolonged period even if physiologists believe that the healthy respiratory system is oversized for exercise. This theory is supported by the fact that human beings do not reach the maximum ventilation capacity during exercise. Above all, research indicates that fatigue of the respiratory muscles (independent of the fatigue of the entire organism) reduces the ability to complete the exercise of resistance. This suggests that if we are able to counteract or delay the fatigue of the respiratory muscles during exercise, the performance of the whole body can improve (Perrotta et al., 2017; Montesano et al., 2013).

In the game of football the player, who plays the role of midfielder, is the prototype of the resistant athlete but in modern football, where the stresses are continuous and intense, to adequately cover all the other roles, goalkeeper (Montesano, 2016) - midfielder - forward, it is necessary to stimulate and strengthen the capacity for resistance that is defined as the ability of the organism to perform a work that lasts over time, or the ability to resist fatigue during prolonged motor activity.

The considerations head off in this article refer to the survey carried out on a sample of 20 senior athletes, without pharmacological treatment, aged between thirty-five and forty-five years old, participating in competitive recreational football activities.

Methods and materials

Subjects
20 male seniors athletes (age 41.2 ± 3.1 years), participating in competitive recreational football activities are enrolled in the study. Volunteered athletes were classified into two group and presented different values of resistance in both training and in the race despite all were equipped with medical-sports fitness with parameters in the standard. The screening was performed with the administration of motor and respiratory tests and, based on the initial results, a supplemental training program was drawn up with respect to the one normally performed.
Detection criteria

The research, led with an observational method and with manual and computerized detection. The course, organized over six months from October to April, involved the administration of the spirometric test, the Cooper test and the calculation of the VO2max with initial and final detection. The initial parameters, referred to the distance traveled and times used, of the initial survey allowed the division of the athletes into two groups: the control group, made up of the athletes with the highest resistance data, called "group A", and the route group, consisting of the athletes with lower indices called "group B".

The two groups, during the racing season, followed the normal training method (Rae et al., 2015) prepared by the technical staff consisting of a weekly training session, characterized by athletic exercises, techniques and tactics, as well as by carrying out training competitions. Only group B, the route group, were given a total of eighteen additional sessions with an average of three monthly sessions.

Prerequisites
Athletes suitable for athletic-sport-type visits and soccer players for many years.

Aim
Increase the resistive capacity to improve the performance in the race.

Methodology
The method used was of an analytical type taking care of the detection of the parameters distance (in meters) and time (in sec / min) and providing the reference of the consumption of VO2max as well as of the active recovery speed.

Materials and equipment
- Regulatory football field (100m x 55m)
- Cones
- Signal flags
- stopwatch
- spirometer
- Computer
- Detection grid

Tests
Spirometry - The more common lung function values measured with spirometry are Forced Expiratory Volume in 1 Second (FEV1). Forced expiratory flow 25% to 75%, Peak expiratory flow (PEF), Maximum voluntary ventilation (MVV), Slow vital capacity (SVC), Total lung capacity (TLC), Functional residual capacity (FRC), Residual volume (RV), Expiratory reserve volume (ERV).

Cooper Test and calculation of the VO2 max - The Cooper test was administered to evaluate the functionality of the structures responsible for athlete's aerobic resistance ensures the "physical fitness" or "fitness". The test is run, how much faster can, for 12 minutes, without interruption on a field or a track or a circuit of 500-1000 m, with signals placed at 50-100 m. The result of the test is the distance that the athlete is able to go in 12 minutes.

Results

Standard reference indices, and valuation, of male test reports (Table1; Table 2), for the age of the participants, the parameters for athletes from 30 to 39 years and over 40. For athletes subjected to detection was proposed an adaptation reduced by around a table 20% considered age and reduced ability to test.
In relation to the performance of each athlete, depending on the distance travelled, the maximum oxygen consumption (VO2max in ml/kg/min) with the formula VO2max = -10,25 + (0,022 x mt).

The data provided by the tests allowed the researchers to develop an additional training program and compare the performances of the athletes with positive parameters compared to those with less positive parameters.

Table 1. Parameter Tests.

Benchmarks Cooper Test				Correspondence distance/VO2max		
Evaluation	Age 30-39 years /distance mt)	Age >41 years /distance (mt)		Category Fitness	Distance (mt)	VO2max in ml/kg/min
Very poor or very bad	< 1990	<1600		Bad	< 1.600	28.0
Poor or mediocre	1900 - 2090	1600 - 2.000		Mediocre	1600 - 2.000	28.1- 34.0
Enough or discreta	2100 – 2330	2000 - 2400		Enough	2.000 - 2400	34.1- 42.0
Vood	2340 – 2510	2400 - 2800		Good	2400 - 2800	42.1- 52.0
Very good	2520 – 2720	2400 - 2800		Excellent	> 2800	> 52.0
Excellent or higher	> 2720	idem				

Additional program contents
The training additional sessions have been organized with work and phases of recovery with general activation, stretching, joint mobilization and workloads related to intermittent method. The intermittent method has the characteristic to take repetitions of exercises in short and medium-length, where the alternation between work and the rest is very frequent. (Seiler et al. 2007).

It's a very intense method as submitting to a maximum load transport system and oxygen usage.

Table 2. Distances, time and recovery time of supplemental program.

Distance (mt)	Duration (sec.)	Recovery (sec.)	Tot. Reps/minutes
40	10	20	5 rip. in 6 min.
50	10	15	5 rip. in 5 min.
80	10	10	5 rip in 4 min
100	12	12	4 rip in 3 min.
120	15	12	3 rip in 3 min
150	18	12	2 rip in 2 min

Initial data highlighted some critical issues in athletes who did not complete the 12-minute course and two groups (Table 3) were formed from the tests results collected, considering that about 65% of the team showed an inadequate performance.

The control group A, which will continue to carry out the normal training program and group B to which the supplemental training program will be proposed (Figure 1; Figure 2). The athletes 4,11,13, recovering from injuries and relative prolonged inactivity, despite having all three 41 years of age have provided non-positive returns comparable to others of athletes with an average age above 45 years. With the subdivision into groups the VO2max is calculated. The methods used was of analytical type curing parameters detection distance (in meters) and time (in sec/min) and providing the reference consumption of VO2max and active recovery speed.

Table 3. Initial recognition.

Group A							Group B					
Athletes	Role	Age	Distance (mt)	Time (minutes)	VO2max		Athletes	Role	Age	Distance (mt)	Time (minutes)	VO2max
1	Goalkeeper	35	1400	10	20,55		3	Defender	45	1250	10	17,25
2	Defender	37	2100	12	35,95		4	Defender	41	850	9	8,45
6	Defender	44	2000	11	33,75		5	Defender	43	1050	10	12,85
8	Midfielder	37	1850	12	30,45		7	Midfielder	43	1100	11	13,95
10	Midfielder	40	1300	12	18,35		9	Midfielder	42	1200	11	16,15
14	Midfielder	41	1300	12	18,35		11	Midfielder	41	1000	10	11,75
15	Midfielder	36	1900	12	31,55		12	Midfielder	45	650	8	4,05
16	Midfielder	44	1550	11	23,85		13	Midfielder	41	900	9	9,55
18	Forward	40	1950	12	32,65		17	Midfielder	44	1300	12	18,35
20	Forward	39	1600	12	24,95		19	Forward	42	1200	12	16,15

Table 4. Final recognition.

Group A							Group B					
Athletes	Role	Age	Distance (mt)	Time (minutes)	VO2max		Athletes	Role	Age	Distance (mt)	Time (minutes)	VO2max
1	Goalkeeper	35	1750	10	28,25		3	Defender	45	1450	10	21,55
2	Defender	37	2200	12	38,15		4	Defender	41	1300	11	1835
6	Defender	44	2050	11	34,85		5	Defender	43	1300	10	18,35
8	Midfielder	37	1900	12	31,55		7	Midfielder	43	1550	10	23,85
10	Midfielder	40	1800	12	29,35		9	Midfielder	42	1550	11	23,85
14	Midfielder	41	1650	12	26,05		11	Midfielder	41	1300	11	18,35
15	Midfielder	36	2050	12	34,85		12	Midfielder	45	1000	9,5	11,75
16	Midfielder	44	1700	11	27,15		13	Midfielder	41	1500	11	22,75
18	Forward	40	2200	12	38,15		17	Midfielder	44	1800	12	29,35
20	Forward	39	2100	12	35,95		19	Forward	42	1450	12	21,55

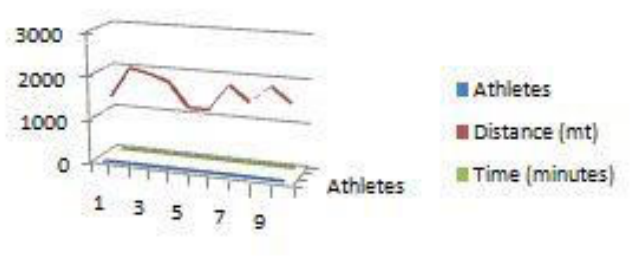

Figure 1. Final survey Distance traveled - Group A.

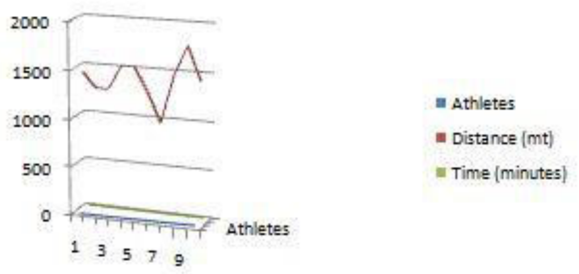

Figure 2. Final survey Distance traveled - Group B.

Discussion and conclusion

The study was conducted to investigate and establish, by administering respiratory and motor tests, the relationship between physical exercise performed to improve the stamina capacity of seniors practicing calcium and lung function. Comparison with the scientific literature (Hopkins et al., 2009) shows that the respiratory functional capacity of athletes could generally be higher thanks to the greater development of respiratory muscles and specific training of respiratory muscles. For the determination of respiratory function and resistance capacity, VO2max of athletes were calculated considering the registry variable as determinant.

In fact, the survey carried out with Cooper's test on the sample of 20 senior athletes showed a poor resistance index particularly in over 45 athletes. The test considered the poor habit of coding a test and the athletic sporting approach of the athletes and was set by calculating a reduction of about 20% for the distances traveled compared to the standard indices.

The entire team has received the initial results and all the players have shown more effort and diligence in training sessions. Group B also carried out the supplementary training program entirely and without interruption. The overall performance improvement, at the end of the planned route, was detected for both groups.

Group A recorded a performance increase of about 18-20% while group B of over 25% with indexes, in some cases, close to 30%. The final parameters confirm that the choice of dividing the athletes into level groups was the right one because it is correct to compare the performances between athletes with different respiratory and resistance indexes.

The planning of an additional work path to the weekly training sessions has produced the desired results considering that the athletes under examination, except in one case, did not practice professional or semi-professional sports at a competitive level, so it was necessary to consider the impact of attention and concentration on the quality of performances. In the observational and numerical survey, it was shown that group A denoted a fairly constant level of performance while group B provided, even in percentage, the most convincing results confirming the effectiveness of the training program. This study showed that the VO2max indices calculated with results data from pulmonary tests can be compared with outcomes of resistance-specific training.

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