International Journal of Physical Education, Sports and Health 2015; 2(2): 260-266

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 4.69
IJPESH 2015; 2(2): 260-266

www.kheljournal.com
Received: 13-09-2015
Accepted: 16-10-2015

Riccardo Izzo
Facoltà Scienze Motorie, Via Oddi 14 CAP 61029, Italy.

Matteo Carrozzo
Facoltà Scienze Motorie, Via Oddi 14 CAP 61029, Italy.

Correspondence
Riccardo Izzo
Facoltà Scienze Motorie, Via Oddi 14 CAP 61029, Italy.

Analysis of significance of physical parameters in football through GPS detection in a comparison with amateur athlete

Riccardo Izzo, Matteo Carrozzo

Abstract
The study brings together the average physical parameters achieved by a professional athlete and an amateur football athlete of different sports, a middle-distance runner / rugby player in our case, the objective of which is trying to reach the physical parameters on average obtained by professional players during a ninety minute match, despite having different abilities, through a run on the athletics track and football field.
The research involves the use of 10Hz GPS (Global Positioning System) technology which allows the detection of actions and movements of the athlete and some ways in which these are carried out via satellite triangulation. The Qualities to which we refer in this study and that will be taken into consideration will mainly be speed> 16 km / h, acceleration> 2m / s / s, deceleration, -2m / s / s and metabolic power,> 20W / kg.
The study aims to demonstrate that it is not impossible to achieve the parameters of the trained professional footballer, especially in terms of strength, speed and acceleration.
Our aim is also to offer some reflections to eventually remodel, if useful and possible, training loads ceilings of professional athletes so far considered optimal.

Keywords: Professional, amateur, training methods, soccer, GPS.

Introduction
Generally professional athletes develop a considerable physical performance with a level of efficiency related to the quality of the athletes. But it needs to be proved if indeed are related to the physical limits of the athlete.
The players, for example, express excellent results in the foundation of the athletic qualities of the sport itself, such as speed, acceleration, deceleration and resistance. Soccer requires a broad specific and efficient physical preparation, which usually leads to increase mainly muscle strength, the coordination and the stability of the lower limbs and the core in all its forms.
The question we asked ourselves is whether the allegedly high level achieved by these professional athletes can be reached by other types of athletes?
The study of the athletic part thus aims at assessing whether an amateur athlete in different sports will be able to achieve the same parameters of a player in a game of 90 minutes, using as a research tool, the GPS 10 Hz, nowadays standardized survey tool. Since this is the first study that deals with this issue, the bibliography is very limited if not inexistent. Also works with the use of GPS are not substantial.
The interesting highlighted aspect concerns subjects correlated, totally different from the physical point of view and the different technique.
On the one hand then the player develops in a relevant way the explosive force of the lower limbs, the strength of the core, the speed of movement and the resistance, the latter in its different forms, general and specific resistance, to be able to meet the physical needs of the sport practiced also seen its duration, with performances which are always kind of ceiling.
On the other hand, the middle-distance runner / rugby player, athlete selected by us, efficiently develops strength and speed and to a greater overall strength, which made it suitable for the study.
A parameter we have considered is the resistance to accelerate and decelerate repeatedly for a prolonged period, which is greater in the player, considering the timing of the onset of muscle.

fatigue and calculated by applying the Borg scale, according to which the athlete according to muscle fatigue perceived gave a personal judgment with a value ranging from 6 to 20, respectively, to no effort (20%) to maximum effort (> 100%, availability);

The results obtained showed that both the players and the middle-distance runner, during competitions, tend to accelerate and not to sprint; In fact, a careful bibliography study has revealed that the players make accelerations and do not sprint, never stopping; the same occurs between the middle-distance runner.

The choice of the athlete for the comparison was carried out by selecting the candidate among athletes practicing different sports, which carried out an acceleration / deceleration pre-test, in order to get a clear picture of the quality and the ability of each subject and choose the most suitable to this research. The experiment was performed through RESEARCH TEAM SPORTS born from the collaboration between the University of Urbino Carlo Bo (ITA) and the K-SPORT and respectively the heads Prof. R. Izzo and Eng. M. Marcolini.

Means and Methods

For the study was used as a tool for data collection a GPS device with a sampling frequency of 10 Hz.

The GPS system is able to analyze all the parameters when compared to the one known as the state of the art technology to the most common ones to be considered as experimental.

Some of the most common are:

1. Position, trajectory and direction change
2. Total distance
3. Speed
4. Acceleration
5. Deceleration
6. Power metabolic
7. Heart rate (GPS + heart rate monitor)

The GPS is a valid measurement tool, although some studies have shown that the validity and reliability of 10Hz GPS for measuring the instantaneous speed is inversely proportional to the acceleration, therefore, those who use the GPS 10Hz should be aware that during accelerations of more than 4 ms-2, the accuracy may be compromised.

In the present study, there were no errors, as the peak accelerations do not go beyond the 4-4.5 m/s/s.

Necessary abilities for the success of the test

- Speed
- Acceleration
- Deceleration
- Resistance
- Strength
- Articular mobility
- Balance

Table 1: Parameters reached by professional football players, data K-Sport 2014, (arithmetic calculation)

total distance = 11 km total
traveled distance at a speed of > 16 km/h = 2 km
traveled distance in acceleration > 2 m/s/s = 650 metri
traveled distance in deceleration -2 m/s/s = 650 metri
traveled distance in metabolic power > 20 W/kg = 3 km

A professional soccer player during a *90 min.* match *reaches* on average these parameters, in terms of the total distance, acceleration, deceleration, distance at a speed greater than 16 km / h and distance to a metabolic power greater than 20 W / kg. On the basis of these parameters a series of tests are created (see above) not to be penalized compared to other professional sportsman.

The experimentation was preceded as anticipated, by an initial selection of amateurs athletes to find the one among them with the most suitable characteristics for the study.

Pre-test

Amateur Athlete

DRILL 4x10

• 4 consecutive sprints
• 5 series
• 10 meters sprint

A 10 meters sprint repeated 4 times in the row. Followed by a 30 ‘‘break and then rerun the series.

Result: the result achieved in terms of acceleration and deceleration reaches an average of 5 m / s / s in both acceleration and deceleration.

During the race an acceleration / deceleration of 10 meters total is disadvantageous it provides a greater muscular effort, therefore less efficient.

Using the 6-20 Borg scale as a method of evaluation of the perceived muscle stress, the athlete who showed a very high muscle distress of about 17-18, was declared not eligible for the test.

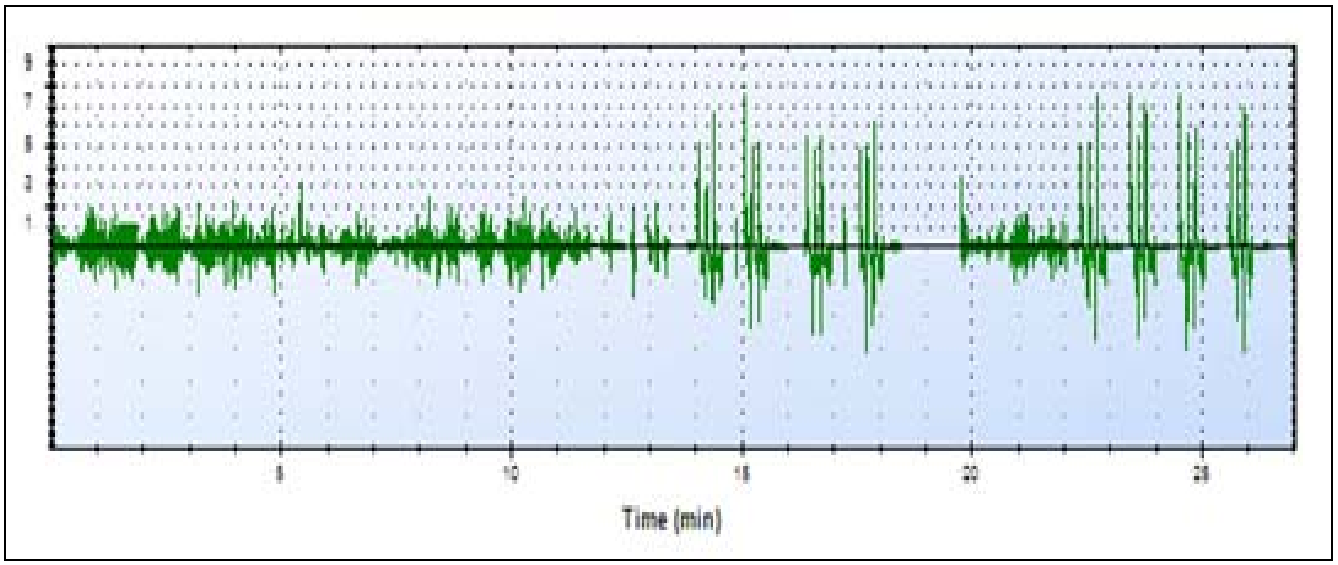

Fig 2: Acceleration graph m/s/s, prozone-kinetic 21/11/2013

Muay Thai Athlete

Test sprint 30 meters

The athlete running a sprint of 30 meters. From the point of view of the acceleration will have excellent results, having peaks that reach 6-7 m / s / s, but after the first few meters a constant speed can be reached and this fatigues the athlete, causing a decrease of the performance. During the course of the test, and then during the race, it is best to accelerate the athlete for a few meters, easily reaching the 2m / s / s, which enforce the long acceleration of 30 meters, which does not allow him to complete the test of the 90 The perceived Muscle fatigue amounted to 16-17 on the Borg scale, considered unsuitable for the test.

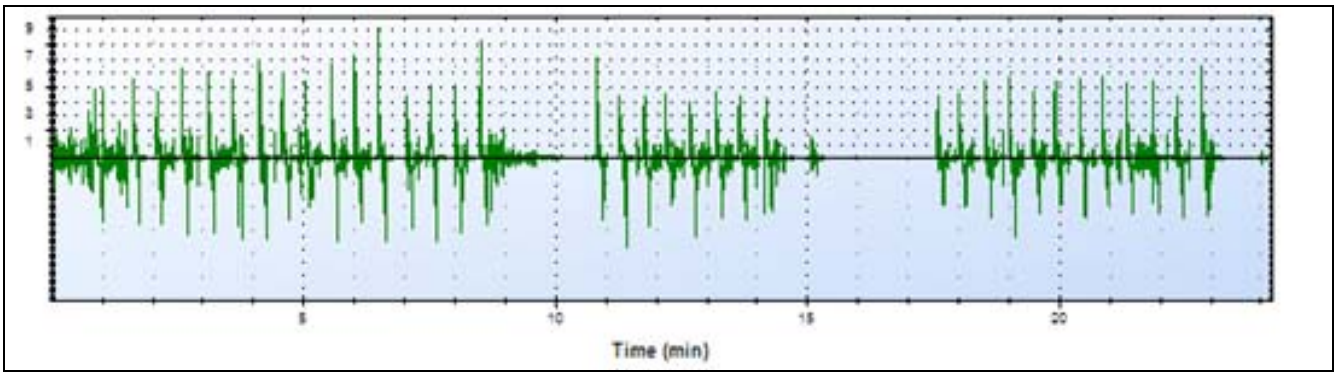

Fig 3: Acceleration graph m/s/s, prozone-kinetic 10/12/2013, the perceived Muscle fatigue amounted to 16-17 on the Borg scale, considered unsuitable for the test

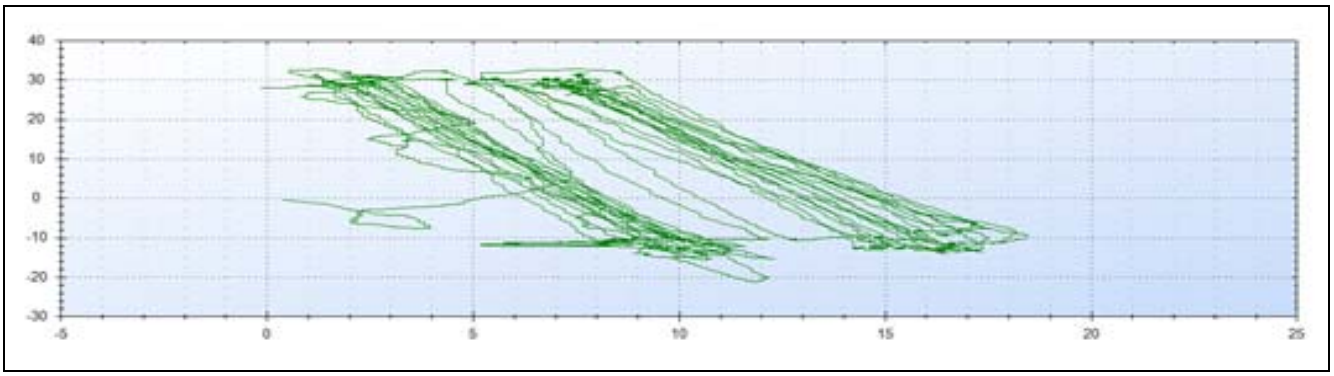

Fig 4: Trajectory (m), Prozone-Kinetic program 10/12/2013

American Football Athlete

CORNERBACK / RUGBY PLAYER

- 5 meters sprint

One sprint of five meters is sufficient to achieve in terms of acceleration and deceleration 2m / s / s. This is the parameter used inside the complete test, as it is less expensive and more efficient.

The chosen athlete is the distance runner / rugby player, for the greater acceleration ability and resistance compared to the others. He showed a muscle commitment equal to 11-12 on the Borg scale, so the most suitable for the test.

Figure 5 here

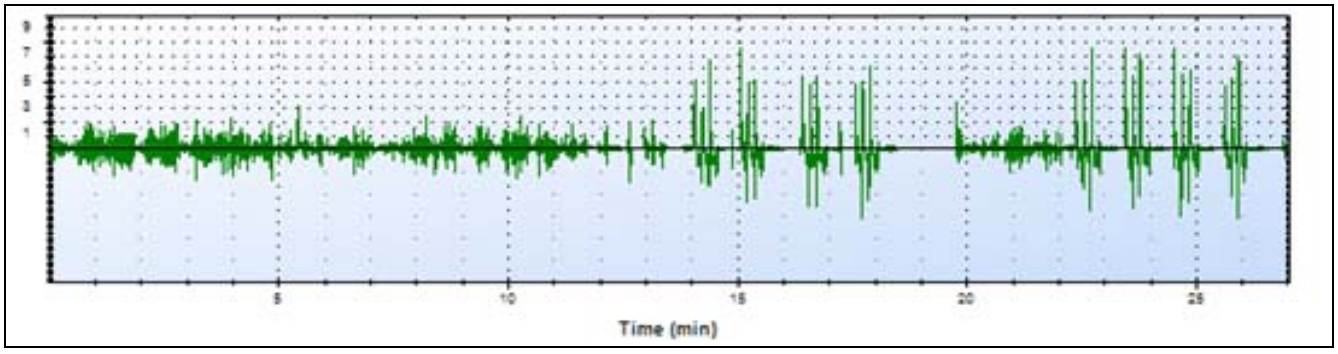

Fig 5: Acceleration graph (m/s/s), Prozone-Kinetic program 20/12/2013

Full Test

- 90 minutes Test performed on the athletics track (Urbino, Italy)
- 90 minutes Test performed on the football field (Urbino, Italy)
- 90 minutes Test 90 'on the football field (Collecchio, Italy)

Complete 90 Minutes Test Performed On the Athletic Track

Athlete: middle-distance runner (5000 m) - Rugby Player

The complete test requires the achievement of the above parameters in terms of acceleration, deceleration, speed and power in W / kg, simulating the movements of a professional football player in a game of 90 'on the athletic track and

football field, along the perimeter of 400m for several kms.
From pre-tests carried out by different amateur athletes, it has been deduced that it's required an acceleration / deceleration of about 5 meters to reach the mentioned parameters. The kilometers traveled are the result of a simple mathematical calculation.

- Justification for the choice Acc. / Dec. 5 meters:

In the 5 meters paths in acceleration, show that there are about 2 meters run above the 2m / s / s, but in 90 minutes time reduces the athlete performance, reaching an average of about 1m / s / s of 5 meters of acceleration, therefore, should be taken into account that the result depends greatly on the quality of the athlete involved.
Calculating by default of 1 meter beyond the 2m / s / s, every 15 meters, multiplied by 26-30 accelerations and for 22 laps of the field, leads to a result of about 650 meters in acceleration> 2m / s / s. The goal is 650 meters (parameter reached by professional players). This doesn't mean that the athlete can't have a good performance for the entire test and reach the full result. It all depends on when the muscle fatigue started.
In this case all depends on the athlete. He/She could reach 2 m / s / s easily for 90 'minutes, following the protocol, or could encounter fatigue in the early stages of the test and have problems in subsequent accelerations. That the test requires, with the possibility of accelerative performance that go below 1 m / s / s.

Table 6: In this test it was necessary a speed variation reached by placing a pin every 15 meters.

22 LAPS
5 Laps above 16 km/h
Acceleration/deceleration at a speed of 2m/s/s for a total of about 5 metres every 15 metres

In this test it was necessary a speed variation reached by placing a pin every 15 meters.
For a total of 26 accelerations per lap.
As mentioned the set parameters take into account the performance of elite athletes. Analyzing the acceleration, this should reach 2m / s / s, considered as high intensity.
In fact in many scientific articles which deal with these subjects, the parameters of acceleration / deceleration are the same.

Results 1st full test on the track

Table 7: Athlete: distance runner / rugby player

Distance traveled: 11,654 m
Distance traveled at speeds> 16 km / h: 2122 m
High intensity Acceleration (AHI): 955 m, of which:
Distance traveled acceleration: 407.89 m
Distance traveled deceleration: 547.74 m
Distance traveled with metabolic power = 20 W / kg: 2179.3 m
From the table we see that the total km have been achieved and exceeded.

With Regard to the acceleration beyond 2 m / s / s the result was of 407.89 meters compared to the 650 meters of the elite reference. It appears to be an excellent result for an amateur athlete from different sports.
Regarding the deceleration the result is even greater, 547 meters beyond 2m / s / s; close to 650m. Positive parameter (2km to 20W / kg) = 2179.3m. The parameter related to the 2 Km over 16 km / h, with a result of 2122m.
This is the most significant test, as the reference parameters were almost completely achieved.

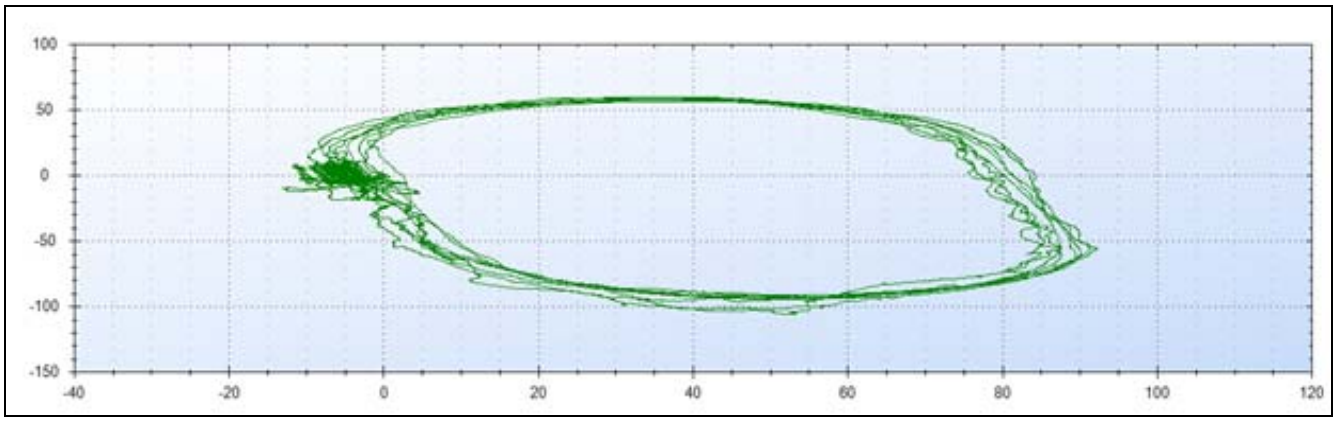

Fig 8: Trajectory (m), prozone-kinetic program 21/01/2014, this is the most significant test, as the reference parameters were almost completely achieved.

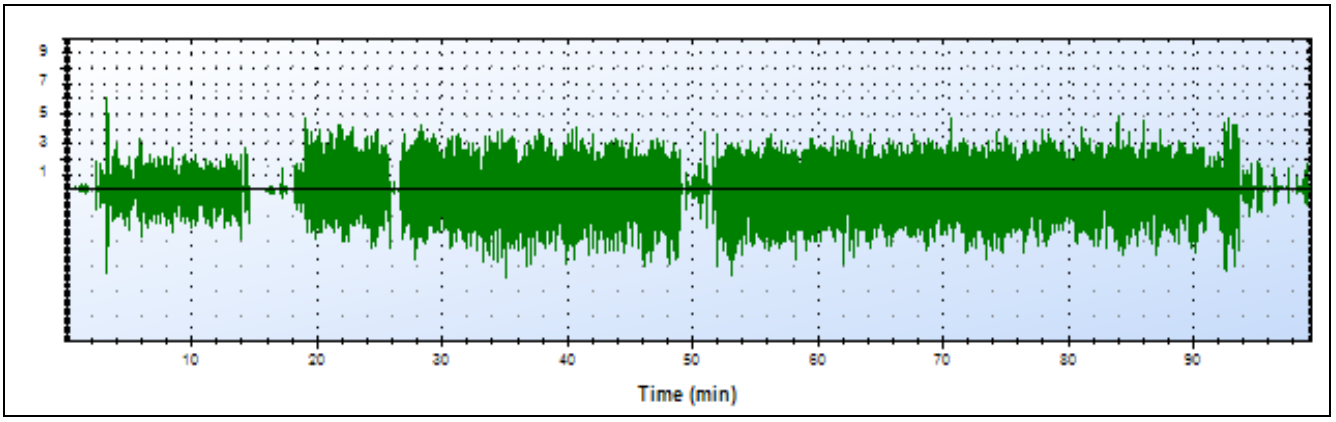

Fig 9: Acceleration graph (m/s/s), prozone-kinetic program 21/01/2014

2nd Test Complete 90' on Football Court

Athlete: distance runner / rugby player (5000 m)

The same test was performed, but on a football field, where the athlete has changed shoes, using the football trainers with cleats.

The parameters to be achieved are the following

Table 10: The parameters to be achieved are the following.

- 11 km in Total: 28 Laps
- Acc/Dec: > 26 per Lap

Changes: in this test the pins were not placed, giving freedom of movement to the athlete, but equally respecting the number of speed variations already carried out in the previous test. Doing so the athlete can independently manage the test, with no obligations.

The result was very similar to the previous one:

Table 11: The result

Total Distance: 11.654 m
AHI: 955 m of which:
Distance covered during acceleration: 422 m
Distance traveled during deceleration: 445 m
Distance Traveled with metabolic power = 20 W/kg: 2877 m
Distance traveled at speeds > 16 km/h = 2196 m

Compared to the first test there was a greater result in acceleration, but lower in deceleration, because not having any reference points the athlete has had a slight difficulty to adjust. Instead we can see excellent results achieved in the following parameters:

Total distance 11,654 m

Distance at power of > 20W / kg = 2,877 m

Distance traveled at a speed> 16 km / h in 2196 m;

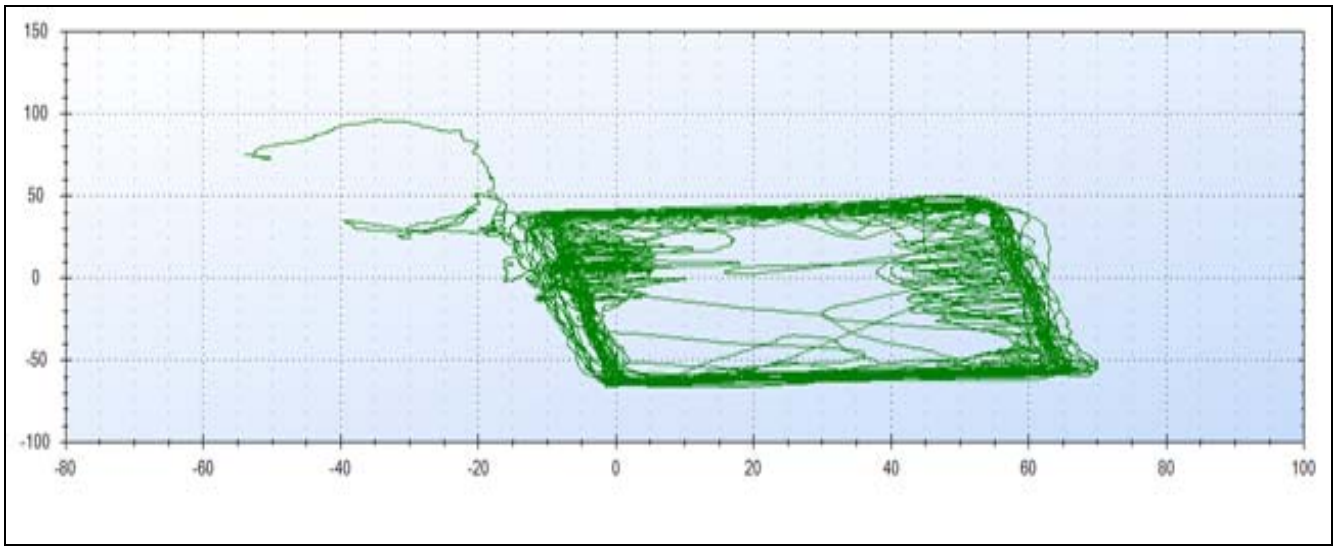

Fig 12: Trajectory (m), Prozone-Kinetic program 1/04/2014

3rd Test Completed On the Court (Collecchio)

The same test was also carried out in Collecchio, new home of the Parma FC, where the whole K-Sport Team was involved. This has allowed us to not only use the GPS 10Hz, but also the video capturing system, made of various components:

- Cameras and optics
- Lighting system
- The object to be examined
- The acquisition and image processing system

This organization has enabled us to have a more complete analysis of the tests performed on the field. The athlete is prepared for the test wearing shorts, soccer shoes, and k-sport, t-shirts with a small pocket on the back where it was added a 10Hz GPS device.

Results

Table 13: The result

Total traveled Distance : 1299,45 m
AHI: 766,96 m of which:
Distance covered during acceleration: 519 m
Distance traveled during deceleration: 246,9 m
Distance Traveled with metabolic power = 20 W/kg: 1598,93 m
Distance traveled at speed > 16 km/h = 1559,93 m

In this test the total kilometers were fully achieved; Accelerations as in previous tests remain more or less the same, reaching 519.9 meters the athlete has used a good metabolic power (1,598.93 meters above 20W / kg) and has reached a fair result in speed over 16 km / h, 1559.93 meters. We consider it an important result because the test was carried out at 8.00 o'clock in the morning.

A less satisfactory parameter is represented by the decelerations, 246.9 compared to the 650 Mt.

In our opinion, the action is more intense and exhausting than the test, requiring high strength and muscle power, which gradually decrease during the performance.

the eccentric force should also be pinpointed, which is usually well developed in football players, thanks to constant training based on the changing of direction, sprinting up and down, and other exercises aimed at the development of such quality that can result in greater acceleration / deceleration capabilities, which is less developed in the endurance athletes.

The normal muscle fatigue and its progressive increase has significantly reduced the desired results in the deceleration.

Comparison Chart between a Professional and an Amateur Athlete

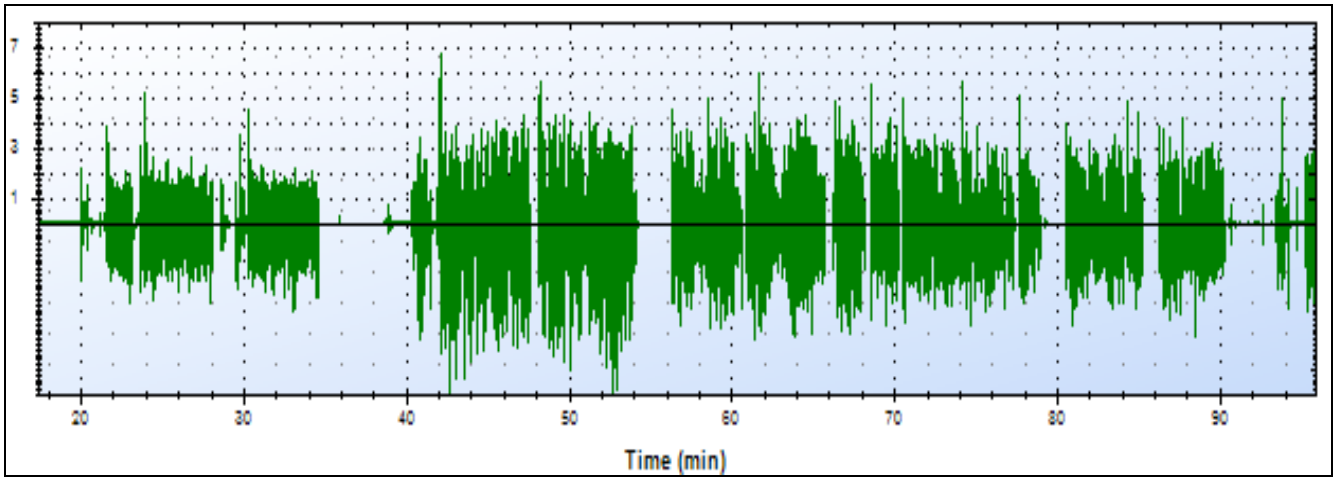

Fig 14: Acceleration graph (m/s/s), prozone-kinetic program 3/02/2014

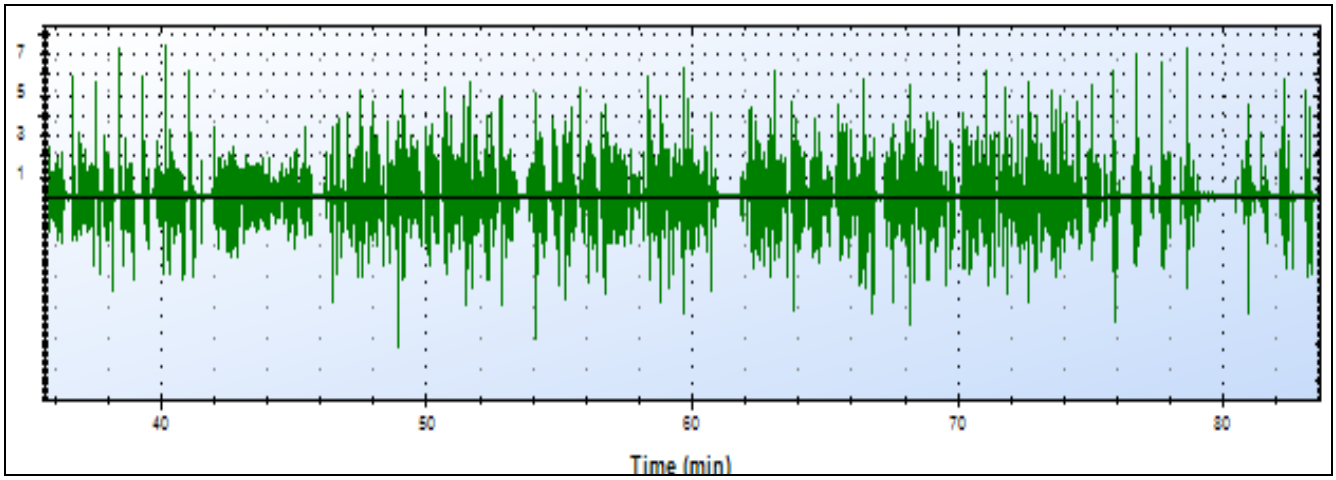

Fig 15: Acceleration graph (m/s/s), prozone-kinetic program 1/04/2014

Looking at the graphs, the speed peaks, acceleration/deceleration, are very similar to each other, showing a small difference between the professional athlete and the amateur athlete.

Discussion and Conclusion

Tests have revealed a substantial equity and the amateur athlete has achieved in good measure the parameters of elite athletes.

The study had some limitations; the non-availability of a high number of athletes to run a very challenging test, different locations, times, and environmental situations.

The 90 minutes complete test was carried out three times, although in different locations, running track and football field.

This allowed us to analyze the differences between the various tests, always performed by the same athlete. There were no significant differences noted, in fact the amateur athlete has reached, more or less, the same results of the professional athlete in the various tests.

Some important decreases, as for the deceleration in one of the tests, are the result of a non-excellent performing situation on the day of the test for external reasons. Anyway the results are very interesting.

It will be even more interesting to compare the level of elite athletes with the lower division series C, for example, of the same sport, to scientifically evaluate any real differences where present.

One element that emerges from the study is that a middle-distance runner, absolutely not accustomed to the "football" effort, has nearly reached the same parameters of a Series a football player, with the exception of the acceleration and deceleration.

Therefore all the most reputable scientific researches, in which the performance is evaluated based on parameters such as total distance, distance at high speed, high power distance, are often inadequate to scientifically the game of football.

References

1. Akenhead R, Hayes PR, Thompson KG, French D. Diminutions of acceleration and deceleration output during professional football match play, J Sci Med Sport, 2013.
2. Akenhead R, French D, Thompson KG, Hayes PR. The acceleration dependent validity and reliability, of 10Hz GPS, J Sci Med Sport. 2014; 17(5):562-6.
3. Barberó-Álvarez JC, Boullosa D, Nakamura FY, Andrín G, Weston M. Repeated Acceleration Ability (RAA): A New Concept with Reference to Top-Level Field and Assistant Soccer Referees, Asian J Sport Med. Epub. 2013; 29-5(1):63-6.
4. Carling C, Gall Le F. J Sports Sci. 2012; 30(4):325-36.
5. Gatteter H, Philippe M, Menz V, Mosbach F, Faulhaber M, Burtscher M. shuttle-run sprint training in hypoxia for youth elite soccer players: a pilote study, J Sport Sci Med. 2014; 1-13(4):731-5.

6. Keiner M, Sander A, Wirth K, Schmidtbleicher D. Long-term strength training effects on change-of-direction sprint performance, J Strength Cond Res. 2014; 28(1):223-31.
7. Johnston RJ, Watsford ML, Kelly SJ, Pine MJ, Spurs RW. Validity and interunit reliability of 10 Hz and 15 Hz GPS units for assessing athlete movement demands, J Strength Cond. Res. 2014; 28(6):1649-55.
8. Nedelec M, McCall A, Carling C, Legall F, Berthoin S, Dupont G. The influence of soccer playing actions on the recovery kinetics after a soccer match, J Strength Cond Res. 2014; 28(6):1517-23.
9. Paulus J, Tong J, Hornegger J, Schmidt M, Eskofier B, Michelson G. Extended stereopsis evaluation of professional and amateur soccer players and subjects without soccer background 2014; 20(5):1186.
10. Russell M, Sparkes W, Northeast J, Cook CJ, Love TD, Bracken RM *et al*. Changes in acceleration and deceleration capacity throughout professional soccer match-play, J Strength Cond Res Epub ahead of print. 2014.
11. Shinkle J, Nesser TW, Demchak TJ, McMannus DM, Effect of core strength on the measure of power in the extremities, J Strength Cond Res. 2012; 26(2):373-80.
12. Fiorini S, Mascherini G, Margheri M, Cattozzo A, Galanti G. Italian Association of Football Athletic Trainers May, Orlando, Florida USA, Soccer Official Match Analysis, A Pilot Study**,** Italy Sport Medicine Department, Florence, Italy, 2014.
13. Urso A, Umili A, Rocchi A. Le basi scientifiche del potenziamento muscolare, Società sportiva, Roma, 2000.