

Performance Training Center Article Series

Phase One: Testing and Assessment 2

By Mark McLaughlin

The training of team sport athletes:

I'm constantly amazed at the amount of scientific data that comes from Europe regarding testing, physical training, and the technical and tactical elements of soccer. Many of these studies are performed on elite/first division players – and not the general “weekend warrior” or untrained twenty-year-old populations. Dealing with high level athletes lends much more credibility and accuracy to the science involved in these assessments.

What can be learned from these studies? Well, factual data on the needs of a game – regardless of the sport involved – will help trainers to design efficient and productive training for their players, which leads to less wasted training time. More precise, sport-specific technical training can be implemented. This sort of training will have a higher transfer to actual games.

For example, if we know that basketball players' heart rates average between 165-175 beats per minute during games, performing shooting, defensive or small-sided games between these parameters for appropriate time frames will allow players to build specific energy systems and practice their skills at the correct intensities.

When players move from the top tier of developmental programs (16-20 years of age) to elite levels, their skills may be highly developed, but sometimes the limiting factor is performing the skill at higher intensity levels they haven't experienced previously. Players must develop the biological power to practice their skills at these new levels.

The RAST:

In this article, we'll get to the nuts and bolts of the RAST test. We'll learn how to perform it, what equipment we need, and how to calculate the required scores. In Part 3 of this series, we'll learn how to examine our Synthesis Test and RAST scores and apply them to the development of programs that improve upon the qualities necessary for success. I will also present some real world examples of athletes I've worked with. I'll show you how we used these tests, along with exercises and programming, to improve their physical fitness.

Anaerobic Fitness:

Anaerobic energy production is a critical component of team sports. The majority of acyclic speed/strength sports fall under the heading of anaerobic-alactic energy production on both the power and capacity levels. Sports like basketball, soccer, football and rugby involve a very high number of explosive efforts (sprints, changes of direction, tackles and jumps) performed throughout the course of competitions. Power output in these activities will have a large effect on the performance of an athlete.

This is why it's crucial to have tests which closely resemble the biomechanical demands of a given sport. Once you have the results derived from such testing, you can design a much more precise training program which will have a greater impact in developing speed, strength, agility and anaerobic power.

The Test:

RAST Test 1996

The Running-based Anaerobic Sprint Test (RAST) was developed at the University of Wolverhampton as a sports-specific anaerobic test. It's similar to the Wingate anaerobic 30 cycle Test (WANT) in that it provides coaches with measurements for peak power, average power and minimum power, along with a fatigue index.

The RAST differs from the WANT with regard to specificity and cost of administration. The Wingate test is more specific for cyclists, whereas the RAST provides a test that can be used with athletes where running forms the basis for movement. The WANT necessitates the use of a cycle ergometer and computer, two pieces of equipment not readily available to all coaches. The RAST requires only a stopwatch and a calculator for some simple computations. The RAST provides a more specific test of anaerobic performance in running-based sports.

Application of the RAST:

Each athlete is weighed before the test. After this, a 5-10 minute warm-up period is followed by a 3-5 minute recovery. The RAST itself is a 6 x 35 meter DIS-continuous sprint. Each sprint represents a maximal effort – with ten seconds allowed between each sprint for turnaround.

The time taken for each sprint should be recorded to the nearest hundredth of a second (the greater the accuracy the better). To perform the test accurately, there will need to be two timers: one to time each run, and another to time the

ten second turnarounds. The athlete must sprint at maximum speed through the line on each repetition. The arrangement for administration of the test can be seen in the diagram below, with the next sprint starting from the opposite end of the measured track.

The time between each run is designed to allow the athlete to return to the start line after running through the line, to record the time, and to reset the stopwatch. The total running time is close to thirty seconds, making the test comparable to the WANT. At the end of the test, the coach will have six times that can be used – along with body weight – to calculate maximal, minimal and average power outputs, along with a fatigue index.

Example results and calculations:

Power output for each sprint is found using the following formulas (Harman, 1995):

The result from the first sprint of one athlete (with a body weight of 74 kilograms and a first sprint of 4.79 seconds) at the University of Wolverhampton can be seen below. The power output for the athlete's first run was calculated to be 825 watts. The power output for each of the other five sprints can be seen in the table below. These were calculated in exactly the same way.

From these power outputs the same measures found in the WANT can be easily derived from the RAST. Maximal power is the highest output, which in this case is the first sprint (825 watts). Minimum power is the lowest output, which is found in the final sprint (376 watts). The average power is found by adding each of the outputs and dividing by 6 (the number of sprints): $3666/6 = 611$ watts. The fatigue index is found by subtracting the minimum power from the maximal power, then dividing by the total time for the sprints: $(825 - 376 = 449)$, $(\text{Time} = 32.2)$, so $(\text{Fatigue index} = 449/32.2 = 14 \text{ watts/sec})$. The results can also be displayed on a graph and used to compare with previous results or with results produced by other athletes.

Explanation of the results:

Maximal/Peak Power Output:

This is a measure of highest power output. The scores in our research have ranged between 1054 and 676 watts. This number provides information about strength and maximal sprint speed.

Minimum Power Output:

This reveals the lowest power output achieved and allows for the calculation of fatigue index. Our range in scores has been between 674 and 319 watts.

Average/Mean Power Output:

This gives an indication of an athlete's ability to maintain power over time. The higher this score, the better the athlete's ability to maintain anaerobic performance.

Fatigue Index:

This indicates the rate at which power output declines for an athlete. The higher this rate, the lower his or her ability to maintain power over the six runs. This can provide the coach with information about the athlete's anaerobic capacity or endurance. With a high fatigue index, the athlete may need to focus on improving his or her lactate tolerance. This could then be made a focus of training. (1)

References:

1. Proietti, R. Energy system requirements of soccer player. Correlation between game analysis and aerobic/anaerobic power test. *Magazine Preparazione Atletica* (www.calciautori.com) November 2007.

