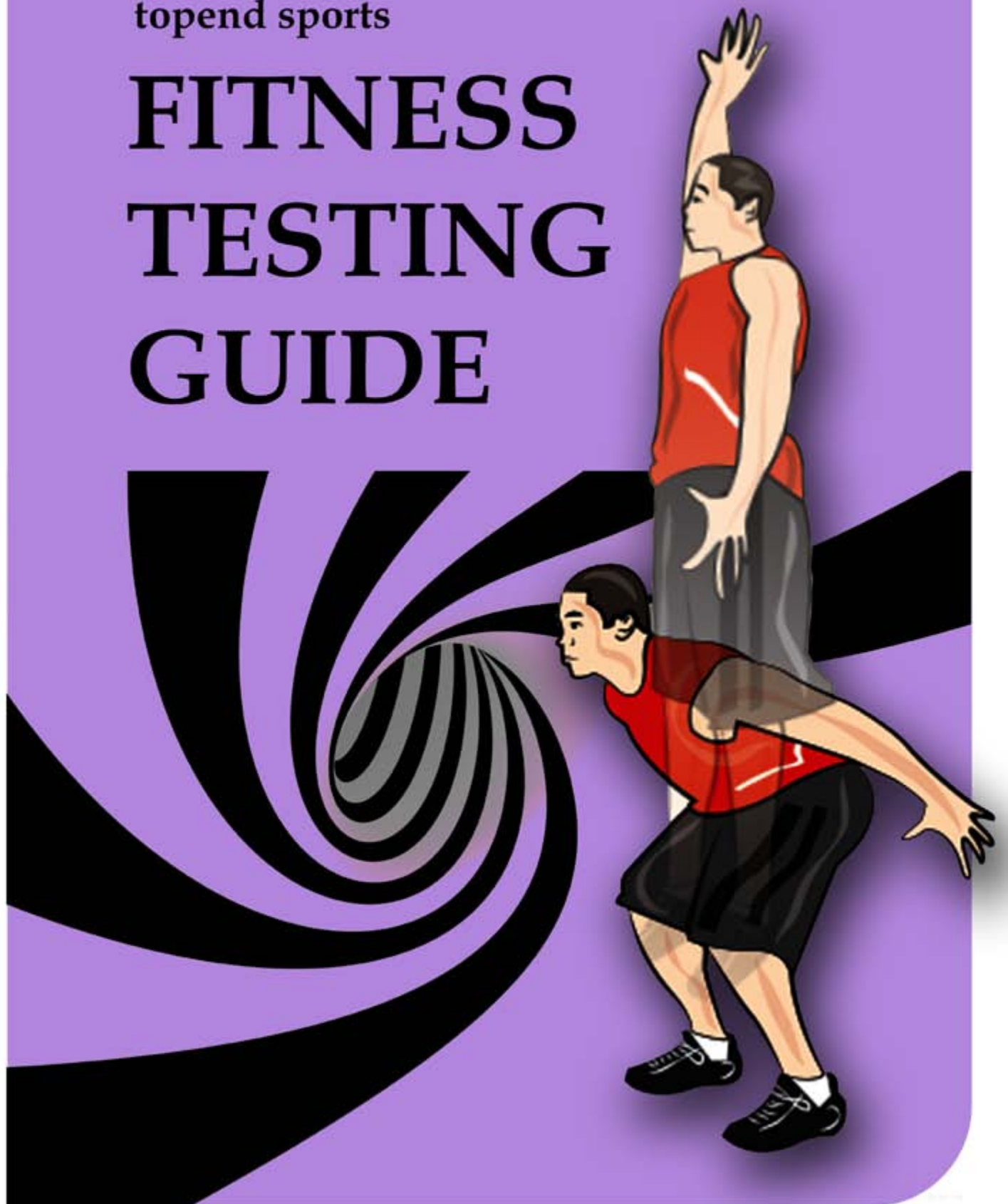


topend sports

# FITNESS TESTING GUIDE



# Topend Sports' Fitness Testing Guide

By Rob Wood PhD



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## 1. Introduction

This guide to fitness testing is suitable for anyone conducting fitness assessments, such as athletes, coaches, teachers, parents, personal trainers and exercise physiologists, who wish to evaluate their own or someone else's fitness level, or to gain a greater understanding of tests that they have performed.

There are hundreds of standard fitness tests in use around the world, and hundreds more variations of these. They can range from elaborate and expensive laboratory tests to simple and inexpensive field tests.

Each test also has many advantages and disadvantages that can ultimately determine which is the most appropriate test to perform. If you are designing your own fitness testing regime, with the information about the relative merits and requirements of each test that is contained in this guide, you can make an informed choice of the most appropriate test or tests to use.

Firstly this guide discusses why we should perform fitness testing and the benefits of testing, then how to select appropriate fitness tests, some tips about conducting tests, and interpret the results. There are also some other resources so you can find some more detailed information yourself.

Once you have a good understanding of the issues concerning fitness testing, you can go and explore the large [list of tests and their descriptions](#) on the Topend Sports website.

## 2. Why Fitness Test?

Performance in any sporting event is the result of a multitude of factors, which include the amount of training performed, the body's adaptation to the training, motivation level, nutritional status and weather conditions to name a few. As you can see, physiological parameters only account for a portion of any performance. Through fitness testing, the factors involving physiological processes, over which there is some control, can be measured and ultimately improved upon.

Competition is the ultimate test of performance capability, and is therefore the best indication of training success. However, when trying to maximize performance, it is important to determine the athlete's ability in individual aspects of performance. Fitness testing attempts to measure individual components of performance, with the ultimate aim of analyzing and maximizing the athlete's ability in each component.

## 3. Benefits of Fitness Testing

### *To Identify Weaknesses and Strengths*

Of the many benefits of fitness testing, the most important is to establish the strengths and weaknesses of the athlete. This is done by comparing test results to other athletes in the same training group, the same sport, or a similar population group. Previous test results of large groups are often published as normative tables.

By comparing results to successful athletes in the same sport, it is possible to see the areas which need improvement, and the training program can be modified accordingly. This way valuable training time can be used more efficiently. However, beware that some athletes perform well in their sport despite their physical or physiological attributes, and it may not always be advantageous to be like them.

### *To Monitor Progress*

The initial testing session can give the athlete an idea of where their fitness levels are at the start of a program, so that future testing can be compared to this and any changes can be noted. A baseline is especially important if you are about to embark on a new training phase. Subsequent tests should be planned for the end and start of each new phase.

By repeating tests at regular intervals, you can get an idea of the effectiveness of the training program. The time-frame between tests can depend on the availability of time or costs involved, or the phase of training the athlete is in. Depending of these factors, the period between tests may range from two weeks to six months. It usually takes a minimum of 2-6 weeks to see a demonstrable change in any aspect of fitness.

### **To Provide Incentives**

The incentive to improve can often be provided by the 'goal' of a certain test score. By knowing that they will be tested again at a later date, the athlete can aim to improve in that area.

### **For Talent Identification**

A general non-sport specific fitness testing battery can determine the basic strengths and weaknesses of the athlete, and analysis if this may indicate the athlete would be suited to a particular sport to make good use of these strengths and physical profile. Although testing has sometimes been used in this way for talent identification, it has generally not been very reliable in predicting the future success of juniors (mainly due to varying growth patterns) and in sports which rely heavily on other factors such as technique, tactics and psychological factors.

## **4. Selection of Fitness Tests**

There is often a standard set of tests that are performed for the fitness testing of any sport. If you do not have access to such as list, or you wish to modify a protocol to suit your individual needs, you can use the following information to design your own testing regime. Remember that the fitness test that best determines the capability in any component of fitness is not always the most appropriate tests to perform; there are many other factors to consider.

### **Identifying Components of Performance**

The first step in designing a fitness testing regimen is to identify the components of fitness that you wish to investigate. These may depend on the phase of training or the phase of the season in which the testing is being conducted. Each sport requires certain physical attributes and relies on certain factors more than others for successful performance. For example, you would not necessarily want to test a marathon runner on sprinting speed. Your fitness testing time could be better spent on doing more relevant tests.

Here are a range of fitness components that you may wish to measure. Not all of these will apply to your sport or athlete, and there will possibly be more than one test in each category you may wish to use.

- » Anthropometry
- » Aerobic Endurance
- » Strength & Strength Endurance
- » Anaerobic Power & Speed
- » Anaerobic Capacity
- » Agility
- » Flexibility
- » Balance & Coordination
- » Reaction Time
- » Sport Specific (Skill) Tests

Your testing battery may include a few similar tests from one fitness component and none from others, depending on what your aims of the testing are.

### **Standardized Protocols**

The test protocols need to be standardized so that comparisons can be made between the test scores performed at different times and comparisons made between athletes tested at different locations.

Athletes and coaches should be aware of the need to control for factors which can affect the results obtained. Such things that need to be controlled are: the warm up, order of tests, recovery periods, environmental conditions, and fluid and nutritional status.

If comparing test results to normative tables, the test must be conducted exactly the same as it was when the original test group was tested, for the comparison to be valid.



## Relevance

The fitness tests need to be assessing the components of fitness related to the sport or at least important to the athlete, otherwise the results will be difficult to interpret, and possibly meaningless. If the athletes believe that the tests are relevant, they will be more inclined to put a maximal effort into the testing.

## Validity

Validity is whether the tests actually measure what they set out to. It is quite possible that a test can be very reliable but not valid. The validity of a test is usually better if the test is specific to the sport being tested: i.e., the tests should resemble the sport being tested, so that similar actions and therefore the specific muscle groups and muscle fiber types actually used in the sport are being used.

There are different forms of validity - internal, external and ecological validity. For an experiment to possess ecological validity, the methods, materials and setting of the experiment must approximate the real-life situation that is under study. A fitness test having external and ecological validity enables you to make 'generalizations' about their sports performance from specific tests.



## Reliability

A test is considered reliable if the results are consistent and reproducible over time. You should be able to obtain the same or similar result on two separate trials. This is important as you are often looking for small changes in scores, and you want the difference in results to reflect the changes in fitness of the person and not an error in measurement.

Some of the errors in recording tests results can come about from poor following of the test protocols, equipment error, and variability in environmental conditions and/or surfaces. Reliability can be improved by greater control of these variables, and by using competent and well trained testers, though there is still some variability expected. All the equipment used should be standard and regularly calibrated to the manufacturer's standards.

If more than one test is being conducted at a time, the ordering of tests can affect results for each test, as can the training and fatigue of the athlete between test sessions. If the test requires pacing or practice, the more experienced athletes will do better at maximizing their performance, and their score will be more reliable.

## Interpretable Results

If you don't know what the numbers in the results mean, the tests are fairly useless. The results must have meaning so that they can be applied to modify a training program. If you want to compare the results to that of other groups you must have access to normative data ('norms'). These norms should be based on a large homogeneous population, be up to date, and preferably be of local origin.

## Facilities and Other Testing Demands

The time, costs, equipment and personnel required can be the most important considerations when selecting a test, and often determines what tests are actually conducted. This is especially important if you intend to test large groups of athletes.

## 5. Conducting Tests

### *Test Preparation*

To ensure that each subject is primed physically to perform up to their potential, they should follow set nutritional and physical guidelines. If all participants follow the same procedures and are in the same physical state, then comparisons are more valid, and if the same procedures are followed for each testing session, then the results will be more reliable.

#### **Nutritional Preparation**

- » Ensure you are well nourished on the day of testing.
- » Where possible, consume a high carbohydrate diet in the 24 hours prior to the testing sessions (such as pasta, potatoes, cereals, toast, fruit etc.).
- » In the two hours before completing the tests do not consume a heavy meal; however, you are strongly advised to have eaten some food in the four hours preceding testing.
- » Caffeine products (such as coffee, cola or tea) should be avoided on the day of testing.
- » Alcoholic beverages and tobacco products should be avoided 24 hours prior to testing.
- » Ensure you are fully hydrated, particularly in hot conditions. Drink regularly in the days leading up to the test, particularly in the 12 hours prior to testing.
- » Top up body fluids by drinking water regularly throughout the testing session. Continue to consume adequate fluids following exercise to replace any fluids lost during testing.

#### **Physical Preparation**

- » Avoid heavy strenuous exercise for the 24 hours prior to testing. Do not exercise at all on the day of testing to ensure you are well rested.
- » Wear appropriate clothing for the conditions (e.g. shorts/track pants and t-shirt/singlet/sports top) and non-slip athletic footwear with laces securely fastened.
- » Remove restrictive jewelry, watches, bracelets or hanging earrings that may get caught in equipment.

- » Do not participate in the testing if you are suffering any injury or illness that is likely to worsen as a result of participation or you are unwell/not in good general health.
- » Be sure to warm-up prior to the commencement of testing.
- » Cool down appropriately. Do not sit or lie down immediately following maximal exercise. Following completion of testing continue moderate-to light aerobic activity (jog or walk) for 5 minutes followed by some light stretching of both the upper and lower body.

#### **Warm-Up**

The actual warm up conducted will depend on the test being performed. Certain tests, such as some variations of the sit and reach test, specifically require you not to do a warm up beforehand, while other testing regimens have tests in a particular order so that the earlier tests provide a warm up for the later tests.

The following is a general warm up procedure that you can use as a basis for designing your own. This is only a guide and you can adapt it based on the time and facilities that you have available. You may wish to include other stretches when a certain part of the body is to be specifically tested.

- » start with 5-10 minutes of light aerobic activity, such as jogging or stationary cycling.
- » stretches to include both upper and lower body. e.g. lunges, quad stretch, calf stretch, side bend, arm stretches.

## Test Sequence

The order in which fitness tests are performed can affect performance in subsequent tests. Here are some guidelines when deciding on the order to conduct tests. These are guidelines that can be used to determine the best order in your situation. There are other factors to consider such as logistics of getting from one test location to another, group sizes, number of assessor, and time constraints. Whatever order is used should be recorded and made consistent for future testing sessions.

- » **Health Checks:** Blood pressure and resting heart rate should always be tested first while the person is fully rested.
- » **Anthropometry:** There should be no physical activity prior to the measurements of body composition. This test should always take place first, and directly after any health checks.
- » **Flexibility:** Depending on whether the test protocol requires a warm up or not, the flexibility tests should be scheduled early in the session prior to any activity, or after a thorough warm up or after the speed tests.
- » **Speed / Power tests:** Power tests are usually performed first, followed by speed, agility, strength, muscle endurance and, finally, cardiorespiratory or repeat sprint tests. A thorough warm-up should precede any speed and power test. The vertical jump test may be performed prior to the sprint test.
- » **Muscle Strength:** Muscle strength (1-10RM) tests should always be completed prior to muscle endurance tests, but after the speed and power tests.
- » **Muscular Endurance:** A minimum break of five minutes is recommended between muscle strength and muscle endurance tests. If there are several muscular strength and endurance tests in one session, you must allow plenty of time for recovery between tests.
- » **Aerobic Fitness:** Many of the submaximal aerobic tests are based on a heart rate response may be affected by previous tests and by the mental state of the athlete, and should be scheduled accordingly. Fatiguing maximal exercise tests, such as a VO<sub>2</sub>max or beep test and repeat sprint tests, should always be scheduled at the end of a session. If the protocol includes both a repeat sprint test and a maximal aerobic test, it is usually wise to have these in separate sessions.

## Scheduling

Testing should be done performed at particular times that correspond to the aims of the tests. For example, you may wish to test at the beginning of certain phases of training, and then at regular intervals to monitor progress. For school groups it may be appropriate to schedule testing at the beginning and ends of school semesters.

## Safety

Safety checks should be done prior to any testing session, such as checking for the proper working of equipment, and adequate supply of safety equipment such as mats, water bottles and first aid kits. During the sessions, give adequate warm-up when necessary. For maximal endurance testing on elderly and special populations (after medical clearance has been given), medical assistance should be close at hand, and adequate resuscitation equipment should be available nearby.

Any person older than 35 years of age, particularly anyone overweight or with a history of high blood pressure and heart disease should consult a physician before undertaking any vigorous testing. Fitness testing should not be avoided, as for this population it can be useful as a screening device and to help devise a program to suit special needs. For all participants that are not accustomed to exercise, it would be wise to conduct a PARQ - Physical Readiness Questionnaire.





## **Recording Sheets**

Well-designed scoring sheets make recording scores more efficient and avoids errors. They should include space for all relevant information. In addition to the test results, the following should also be recorded with every testing session:

- » date and time of testing
- » personal details (name, age, contact details)
- » current state of the athlete (fitness level, any injuries, health status, fatigue level, sleep)
- » activity details (sport involved in, event)
- » basic physiological data (weight, resting heart rate)
- » current training phase (e.g. speed, speed endurance, strength, technique)
- » current training load (the number of miles, the number of sets and repetitions, the number of attempts)
- » current training intensity (kilograms, percentage of maximum, percentage of VO<sub>2</sub>)
- » environmental and surface conditions (wet, slippery, wind, temperature, humidity, indoors?)
- » name of assessors

## **Test Assistants**

All test assistants should be adequately trained prior to testing, to ensure correct administration of the tests, and reduce error between testers.

## **Session Organization**

Good organization will ensure the testing session runs smoothly. If testing a large group, you may want to set up testing stations with a different tester at each station, or with one tester following the same group around the stations.

## **6. Interpretation of Results**

### **Relative Importance**

The first step in the interpretation of test results requires you to determine how important each of the components that were tested are to the overall performance in the sport. For example, while a poor result in a body fat test for a basketballer may be of concern, it is not as vital as a poor result in an endurance test. The relative importance of each fitness component normally requires a good understanding of the physiology involved, and so is best done by a qualified exercise physiologist.

### **Comparison to Norms**

If the results are being compared to normative values (norms), you must consider if the norms used the same protocol, and the subject population and age group are similar. Also, published norms and rating charts may give the averages for a certain population, but this does not always indicate what is the desirable level for that particular parameter.

### **Significance**

Are the changes seen from test to test significant? There is normal variation in results from test to test due to factors such as biological variation, tester error, equipment calibrations, conditions, etc., so you must decide if the differences recorded are significant to affect performance, and are greater than can be expected from general sources of error.

### **Presentation**

Following correct and thorough testing, the presentation of results to the athlete or coach can be the most important step if any recommendations are implemented. A good way of illustrating the results is with a chart or plot, where initial and subsequent tests can be overlaid or compared side to side so that changes over time can be easily determined.

## References

More information on fitness testing and a large list of tests can be found on [Topend Sports](#).

Here are some other references for those looking for more information about fitness testing.

- » **Guidelines for Exercise Testing and Prescription**, American College of Sports Medicine, 9th ed, Lippincott Williams & Wilkins , 2013.
- » **Physiological Tests for Elite Athletes by Australian Institute of Sport** , 2nd edition (eds Rebecca Tanner and Christopher Gore, 2012)
- » **Measurement and Evaluation in Human Performance With Web Study Guide-4th Edition** by James Morrow Jr., Allen Jackson, James Disch, Dale Mood. 2010
- » **Physiological Assessment of Human Fitness - 2nd Edition** by Peter Maud and Carl Foster (2005)
- » **Companion Guide to Measurement and Evaluation for Kinesiology**, David Tomchuk, 2010.
- » **Fitness Testing 101 - A Guide for Personal Trainers and Coaches** By Patrick S. Hagerman, 2001

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