

# **Introduction to Exercise Physiology & Sports Performance**

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**Lecture – 36**

## **Role of performance testing**

Good morning, ladies and gentlemen and welcome to week 8 of this course of exercise physiology and sports training. Today we will be discussing the role of performance testing in lecture 1.

In week 8 we will be covering performance testing and analysis. We will also be covering exercise in disease management and exercise in disease prevention. And at the end of the week as usual there will be an assignment and since this is the week which culminates the course there will be an exam wherein you will have to do the assignment and submit the papers online.

I will be covering this topic under the following headings: Introduction, Performance testing, Design and ethics of testing, Reliability of testing, Gains for the athlete, Components of testing, and Conclusion.

Testing is of no value unless the information gained is used to improve your training or to confirm that you are training in an appropriate manner. This has been said by Joe Friel in the triathlete's training bible.

Physical fitness testing is very important for the assessment of general conditioning and student progress in the general population. However, on-field testing does not provide the detailed physiological information which is required for the athletes. And for athletes more specific laboratory tests are required to provide detailed physiological information about performance in athletes.

There are two principal approaches for the assessment of physical performance. You can do field tests for physical fitness and physical performance. You can also do laboratory assessments for physiological parameters such as VO<sub>2</sub> max, anaerobic power, and exercise economy.

Performance tests differ from exercise tests in several ways. Exercise tests are targeted towards assessing cardiorespiratory fitness in healthy adults. The performance tests, however, are targeted towards the measurement of performance in athletes who are actively engaged in competitive sports. When we talk about designing lab tests, it requires an understanding of the factors that contribute to success in a particular sport event or competition. Physical performance is determined by a body capacity for maximal energy output i.e. the maximal aerobic and anaerobic processes, muscular strength, coordination, economy of movement, psychological factors such as motivation, tactics, drive, etc., and environment. Many athletic events require a combination of several factors for an outstanding performance to occur.

If you look at golf, it requires little high-energy output but requires a lot of coordination. Sprinting 100 meters requires good technique and high anaerobic power output. In distance

running, cycling, or swimming, a high capacity for aerobic production of ATP is essential for success. A test that stresses the same energy systems required by the sport is required to provide a valuable assessment of physical performance.

When we test any human subjects, ethics come into play. A key concern in the performance of athletic laboratory testing is to maintain the respect for the athlete's human rights. Laboratory testing should be performed only on athletes who are volunteers and have given written informed consent prior to testing. Informed consent is a process that has to be gone through by both the principal investigator and the volunteer and at the end of the informed consent process, both of them have to sign the form of informed consent. The exercise scientist or the principal investigator has the responsibility of informing the athlete about the purpose of the tests and the potential risks associated.

Reliability of the tests. For a physiological test of human performance to be useful, the test must be reliable, that is, the test results must be reproducible. Factors which influence the reliability of physiological tests are the caliber of the athletes tested, the type of the ergometer used during the test, and the specificity of the test.

Physiological tests of performance are more reliable with highly trained and experienced athletes because these athletes are highly motivated to perform, they are better able to pace themselves, and they have less variable perceptions of fatigue. Exercise tests which mimic the actual sporting event are more reliable. Testing racing cyclists on a cycle ergometer is a more reliable performance test than testing them on treadmills.

What does the athlete gain from all this? We are exercise scientists, we gain a lot, but what does the athlete gain from all this? We know that laboratory measurement of physical performance can be expensive and time-consuming. A testing program can benefit the athlete and the coach in at least three major ways.

Physiological testing can provide information regarding an athlete's strengths and weaknesses in his or her sport, which can be used as baseline data to plan training programs. The exercise scientist can measure the physiological components separately and provide information about which components require improvement. This information gives an individualized exercise prescription that concentrates on the identified areas of weakness for the athlete.

Laboratory testing provides feedback to the athlete about the effectiveness of a training program. For example, if you compare the results of the physiological test before and after a period of training, the athlete and the coach can evaluate whether the training program is a success or not.

Laboratory testing educates the athlete about the physiology of exercise. The athlete learns in depth about the physiological parameters that are important to success in his or her sport. And athletes who have a basic understanding of exercise physiology will make better personal decisions regarding the design of the exercise training program and nutritional programs.

We have seen what lab tests will do. Let's see what lab tests will not do. Please note laboratory testing of the athlete is not a magical tool which will suddenly produce Olympic gold medalists. Lab testing has its limitations. As it is difficult to simulate in the laboratory the physical, physiological and psychological demands of sport. It is challenging to predict athletic

performance from laboratory measurements. And laboratory measurements should be primarily considered a training aid for the coach and the athlete.

There are several components of effective physiological testing. The physiological variables tested should be relevant to the sport. For example, if you test maximal hand grip strength in a distance runner, it is definitely not relevant to the distance runner. Physiological tests should be valid and reliable. Valid tests are those which measure what they are supposed to measure. And reliable tests are those tests which are reproducible.

Test should be as sport specific as possible. We have discussed this. For example, the distance runner should be tested on a treadmill and the cyclist should be tested on a cycle ergometer. Please note test should be repeated at regular intervals to provide the athlete feedback about the training effectiveness.

Testing procedures should be rigidly administered in carefully controlled environments. For test to be reliable, the testing protocol should be standardized. Test results should clearly be explained to the coach and the athlete because without this, there is no point in conducting all these expensive time-consuming tests unless the coach and the athlete and the exercise scientist have a discussion about what is lacking, what is not lacking and how to improve the training programs.

There are some factors which have to be controlled for effective physiological testing. The instructions given to the athlete prior to testing, the testing protocol itself, the calibration of instruments involved in the testing, environmental conditions such as temperature and humidity, the time of the day for testing, prior exercise, diet standardization and other factors such as sleep, illness, hydration status or injury.

What is the take home message for all of us? Designing laboratory tests to assess physical performance requires an understanding of the sport. Physical performance is determined by the interaction of several factors.

To be effective, physiological tests should be relevant to the sport, valid and reliable, should be sport specific, should be repeated at regular intervals ideally at the end of every training phase of the training program. These tests should be standardized and last but not least, they should be interpreted to the coach and the athlete, the sports scientist, the coach, the athlete and the physical conditioner should have a free, frank and comprehensive discussion regarding the test, the performance and the manner in which the performances can be improved.

These are the references, ladies and gentlemen. I strongly urge you to go through them.