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## A new paradigm: correlation between laboratory and field tests of Coordination

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### Abstract

The study aimed to compare the coordination tests in the study and those used in the laboratory and field. Thus coordination tests used in the field and in the lab were applied to individuals in pursuit of these aims and the relation between the results was investigated. It was thus aimed to demonstrate the utilitarian value of the measurement methods in the field in contrast to the high cost laboratory coordination tests. 69 Individuals (male:49: female 20) between the ages of 18-30 participated in the study on volunteer basis. In order to determine the coordination skills of the study participants, Throwing a Ball at the Target Test, Dart Test from the field tests and Double Hand Eye Coordination Test and the Flamingo Balance Test from amongst the laboratory protocols was applied. In conclusion there was a correlation between the double hand eye coordination test and the dart test ( $r=0,245$ ;  $p=0,43$ ). As a result it was decided that the dart test was adequate in measurement of the coordination skills and taking them into account its usability in the field, it was decided that it could be used in place of the expensive laboratory tests.

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### INTRODUCTION

Coordination; this is the harmonized interaction between the skeletal muscles and the central nervous system during a purposeful act (1). The utilization of these systems for a goal-oriented act is only possible through coordination of the intramuscular muscle-nerve systems. Intramuscular coordination; on the hand is the

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harmonized working of the different muscle groups towards execution of a goal-oriented act; (2). A muscle cannot work alone in any type of act to carry out an act, when executing an act more than one muscle group participates in the act (3).

Coordination is an important factor that determines the technique. Sports efficiency coordination cannot be attributed solely to conditional or metabolic processes; it also involves psycho-neurological processes as well. **Coordination exercises**, ensure that the acts are carried out in a rapid, high efficiency, safe, aesthetic and goal-oriented manner (4,5). An individual with coordination attributes may produce act of longer duration. Their muscles tire less when carrying out the act thus they are able to sustain the act for a longer period (6,7,8). Therefore in order to be able to understand the athlete's condition and development during sports workouts and in order to be able to assign the suitable training and to organize the training as efficient as possible, providing the coaches with coordination exercises and measurement tests would be beneficial.

The test concept has a different definition in sports. Test is specific to the individual and is a behaviour sample obtained from the individual that determines the repetitive behavioural invariants. Motor sports tests are affected by many factors such as; technical, tactical, psychological factors. For example the long jump distances are not achieved through only jumping power. The distance achieved is a result of the combination of factors such as, jumping power the ability to apply speed technique, ability to learn, compliance and the competitive environment (9). Scientific sports research allows acquiring new information on workout methodology.

The study examines the relationship between the coordination test between the field tests and the laboratory test by comparing the two classes. Therefore the aim was to determine the usability of field coordination measurement tools in place of the more expensive laboratory measurement tools. Amongst the tests included in the study is the test to measure balance ability. Because balance is perceived as a component of acquired coordination skills. Also as activities requiring skills such as hand to foot, hand to eye coordination, ball throwing and catching skills, are perfect training for motor development in adolescent boys (10) the laboratory test for measuring of hand to eye coordination and ball throwing to a target and the dart test from the field tests were in field tests were included.

## 2. Material and Methods

### 2.1. Subjects:

A total of 69 individuals from students at the Physical Education Higher College, with ages between  $22,57 \pm 2,14$  (years), with heights of 175,03 (cm) with weights of  $68,10 \pm 10,34$  participated in the study on a volunteer basis. The sport ages of the participants in the study are  $5,27 \pm 3,81$  (years). All the tests specified below were applied to all the participants during the same day in the sequence given.

### 2.2. Laboratory Tests

#### 2.2.1. Double Hand - Eye Coordination Test

This test measures the motor coordination and learning capacity of both hands working together. The subject holds the two arms of the test device in both hands and moves the pencil. The object is to trace a six pointed star with the pencil. When the pencil strays outside the star, the duration between two full traces of the star is recorded. The subjects take the test standing up in front of the table in a comfortable position so that they can grasp the both arms of the device (11).

### 2.2.2. Balance Test (Flamingo)

The aim in this test is to measure the balance skills. Flamingo balance device is 4 cm high and 3 cm wide. In order to prevent the balance device from slipping on the floor it is supported by two feet that are 15 cm long and 2 cm wide. The subject is requested to stand on the device with his dominant foot and to hold the other foot with his opposite hand behind his back. When the subject loses his balance and touches the ground with his feet or when he lets go off the other foot, the chronograph is stopped. The person applying the test helps the subject to regain their balance. When the balance is restored chronometer is started again. Test is repeated until a 60 second interval is completed successfully. Every fall is counted and recorded (12).

### 2.3. Field Tests

#### 2.3.1. Throwing a Ball at a Target Test

The object of this test is to measure hand to eye coordination. The test uses, tape measure, tennis ball, packing tape and three different coloured cardboard. The subject stands behind a line that has been drawn at 3 meters distance from the wall. The wall has a target, whose lowest point is placed at a height of 1,5 meters from the floor. The smallest square in the middle of the target is 10x10 cm, the one outside of that is 30x30 cm and the outer one is 60x60 cm. The subject makes 10 throws at the target. When they hit bulls eye that counts as 3 points than 2 points is awarded for the next square and 1 point for the outer square. No hitting the target is given 0 point. Test is repeated twice and the best score is recorded (13).

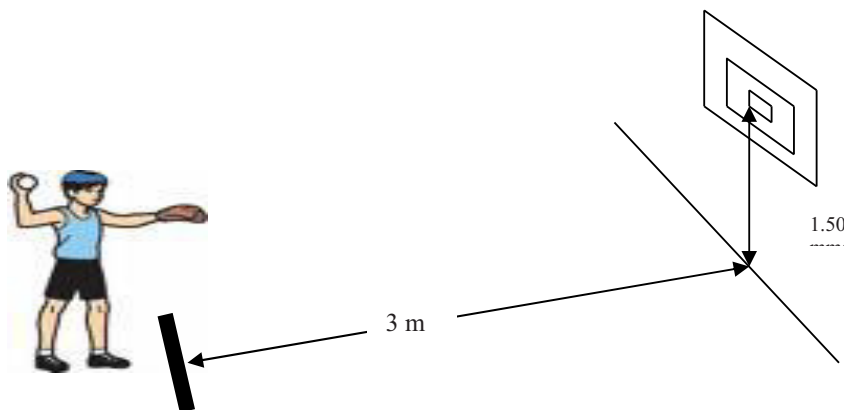


Diagram 1: Throwing a Ball at a Target Test.

#### 2.3.2. Dart Test

Dart board is divided into 20 parts that emanate from the center with 3 sections with different scores. Each section is numbered and the numbers are spread randomly around the circumference. Each sections score corresponds to the number on the outside. The first bounded section is on the outside and any score here counts as double of the number and the inner bounded section counts as triple and sections in between the count as a single score. There is double ringed bulls eye in the middle outer ring counts as 25 points and the inner one as 50. International standards were used in the preparation of the dart performance test environment.

Dart board has been hung at a height of 173 cm from the floor taking its center point as a reference. The throwing line is marked out at a distance of 237 cm from the center. Thus the straight line from the central point to the throwing line is 293 cm long. Before starting the dart performance evaluation, the subject group was warmed up. In order to ensure a standard warming up process a protocol was prepared, and all the subjects were subjected 5 minutes of hand, wrist, arm and shoulder warming up exercises and stretching exercises. In the second part of the warm up exercises all the subjects threw between 180 darts to 200 darts. In the evaluation of the dart performance evaluation, the total score from 30 darts was recorded. The subjects were separated into groups and the throwing was organized as a series of 10 with 2 throws per series, to give a total of 20 darts, at the same time for all the groups. At the end of each series the 2 day scores were recorded by the researchers or their assistants. This test was repeated twice and the highest score obtained by the subjects was onto a form as their dart performance value (14).

*Statistical Analysis:* For statistical analysis the Windows based SPSS 18.0 statistical analysis software was used. As a result of the analysis (Shapiro-Wilk Test) carried out, it was determined that all the parameters conformed to a normal distribution. Pearson correlation analysis was used to determine the direction and the strength of the correlation between the parameters.

**4. Results**

Table 1: Balance, Double Hand Eye Coordination, Throwing A Ball at the Target and Dart Test points.

n=69	Balance (point)	DHECE (point)	DHECD (sec)	TB (point)	DP (point)
Min	0	0	30	13.00	284
Maks	11	20	99	24.00	532
Mean	1,60	3,66	62,84	16,93	391,60
<b>Std. Dev.</b>	1,92	4,00	18,02	2,77	60,97

**DHECE:** Double Hand, Eye Coordination Error, **DHECD:** Double Hand Eye Duration, **TB:** Throwing A Ball at the Target score. **DP:** Dart Point.

Table 2: Correlation between the Field and the Laboratory Tests.

n=69		TB (point)	DP (point)	Balance (point)	DHECE (sec)	DHECD (point)
DP	(r)	,306*				
	(p)	,011				
Balance	(r)	-,213	,083			
	(p)	,080	,498			
DHECE	(r)	-,065	,245*	,153		
	(p)	,595	,043	,209		
DHECD	(r)	,162	,232	-,031	-,171	
	(p)	182	,055	,803	,160	

There is an highly significant correlation between the dart test in the field test and the throwing a ball at the target test ( $r=0,31$ ;  $p=0,01$ ). Also there is a significant correlation between the laboratory tests, double hand eye coordination test (duration) and the dart test scores ( $r=0,25$ ;  $p=0,04$ ).

## 5. Discussion

Due to the excessive cost of the laboratory tests and the absence of laboratories in many places that train athletes, prevents the conducting of these tests. In this study the aim was to determine the correlation between coordination measuring laboratory tests and the field tests that are easier and more economically implemented.

There was a significant correlation between the field test dart test score and the laboratory test double hand eye test duration score. Although there was a high correlation between error points and the dart test, this was not considered as significant ( $p=0,05$ ). During the application of these tests the student is standing up and applies the coordination skill without shifting their weight. This is why there may be a correlation between the two measurements. Again there was a significant correlation between the dart test and the throwing a ball at a target field test. Because the movements are the same in both tests such as the targeting, throwing, arm strength parameters, these tests can be used interchangeably. It can be said that the throwing a ball at the target field test can be deemed as a test that measures the required skill at the level required level while being economical as well.

A significant correlation between the balance test and other parameters was not found. Because balance is related to the control of the center of gravity and relative positioning of the body. This control is achieved through the coordination of the elements that assist contraction and this coordination is activated by the stimuli emanating from the primary motor cortex (15). In order to maintain a good balance, the right and left side extensor and flexor muscles, medial and lateral rotators and upper body must work equally in unison (16). This may be the reason why there isn't a correlation between the balance test and tests requiring hand to eye coordination. It can be said that in sports branches that require hand skills, the joint use of balance and hand to eye coordination measuring test is advisable.

Coaches or sports trainers can be advised that using the throwing a ball at the target test provides a similar result to laboratory measurements and the darts test, it can be uses to measure hand to eye coordination as a simpler and a more economical alternative.

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