FLIGHT AS A MEASURE OF LEG POWER

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A basic motor ability involved in many different motor tasks is anaerobic muscular power. Defined as the ability to rapidly generate and apply large amounts of force and thereby impart high velocity to the body, its segments and/or external objects, this ability is involved in the successful performance of virtually all running, jumping and throwing events for which muscle strength and speed are important.

With the increasing recognition of the importance of power to selected athletic events, has come the need for objective, reliable tests to measure an athlete's power-producing capabilities. Unfortunately, measuring power output has been, technically, extremely difficult to do. Measuring power requires the ability to accurately measure the speed of a muscular contraction, as well as, the force being generated. Until quite recently, the technology to accomplish this has been complicated, expensive and, for the most part, unavailable to most athletes, coaches, and sports scientists. However, the current state of digital electronics suggests that the development of a new, accurate, inexpensive test for measuring explosive leg power might be possible.

The basic tool for the serious study of jumping activities is the force platform. It provides a direct measure of two principal components responsible for the success of the jump; force and time. This device is essentially an electronic scale which measures the magnitude of the vertical and two horizontal forces, the torque about the vertical axis and location of the resultant forces acting on the platform. With such equipment it is easily possible to obtain accurate, reliable force-time curves for the support phase of jumping activity. Leg power can then be easily calculated. Unfortunately, this approach is confined to the research laboratory and has very little "field usability." The development of an alternative "performance based" model for the measurement of leg power that will meet the need for a "field usable" test has been started by Lightsey at the University of Northern Colorado. The theoretical basis for his model is presented in his paper published in these proceedings.

The purpose of the present study was to compare the results obtain from Lightsey's power test with the results obtained from the traditional "jump and reach" test and with a "time of flight" measure.

PROCEDURE

In the study by Shetty, et.al., eleven male subjects were required to execute two maximum standing vertical jumps from the surface of a force platform while not using their arms. The subjects then performed two

additional jumps using their arms in a typical "jump and reach" fashion, for the purpose of providing data for this study. For the "jump and reach" test a scale was marked off by parallel lines one inch apart and mounted on a wall. The jumpers made two marks on the scale: one made while standing feet flat on the floor and arm next to the scoring board fully extended; the second made at the height of the jump. The distance between the two marks was the distance jumped.

The force platform was used to measure the interval between the take-off and the landing of each jumper. This time was the "time of flight" of the jumper.

RESULTS

The jump and reach score, time of flight score, power score obtained through Lightsey's formula for height data, and the power score obtained from the force platform data are presented for each subject in Table I.

The correlation between the jump and reach scores and power scores obtained from the height data was -0.02, and between the jump and reach scores and power scores obtained from the force platform data was -0.139.

TABLE I

DATA OBTAINED WHEN SUBJECTS WERE ALLOWED TO USE THEIR ARMS

SUBJECT	TIME OF FLIGHT (SEC)	JUMP AND REACH (INCHES)	POWER (WATTS) FORCE PLATE	POWER (WATTS) HEIGHT DATA
1	0.53	17	1932	2032
2	0.55	19	1209	1415
3	0.46	14	1232	1276
4	0.54	18	2107	2116
5	0.48	16	2450	2681
6	0.48	17	2288	2482
7	0.63	15	1788	2105
8	0.56	20	2140	2231
9	0.52	17	2580	2684
10	0.60	17	1764	1570
11	0.62	24	1753	1624

The correlation between the time of flight scores and power scores obtained from the height data was -0.263, and between the time of flight scores and power scores obtained from the force platform data was -0.196.

The correlation between the two sets of power scores was 0.952.

CONCLUSIONS

The near zero correlations between the jump and reach scores and both power scores and between the time of flight scores and both power scores suggest that the jump and reach test and the time of flight test are not measures of power. The 0.952 correlation between the two sets of power scores further validates these two tests as measures of the same quantity.