where t_r would be used for the upper limit of integration. The average power could then be obtained by dividing the work by t_r, i.e.

$$\langle P \rangle = W/t_r \qquad \text{(eq. 12)}$$

In Shetty's study height measurements were made cinematographically to compare with the force platform data. In addition, the time-of-flight, T, was obtained from the force platform data, and used in the free fall equation for vertical projection

$$V_r = gT/2 \qquad \text{(eq. 13)}$$

as a third method of determining the release velocity.

VALIDATION OF LIGHTSAY LEG POWER FORMULA

Anand Shetty
Kevin Spooner
Jerry N. Barham
Mechanical Kinesiology Laboratory
University of Northern Colorado
Greeley, CO 80639

Paul A. Lightsay, Department of Physics

The purpose of this study was to compare the results obtained through Lightsey's formula for the calculation of approximate leg power from height data measured from filmed standing vertical jump performances with those obtained from precise force-platform measures of the same performances.

A Kistler force-platform utilizing piezo-electric crystals was used to obtain force vs time data for the standing vertical jump. Eleven male college students performed two maximum standing vertical jumps from the surface of the platform without using their arms. Force vs time data were obtained from the platform at a frequency of 100 hz in the form of amplified analog signals which were converted to 12 bit digital data and stored via interface circuitry on an Apple IIe computer. Lightsey's protocol for the measurement of velocity, power, and work from force vs time data was used by Kevin Spooner and Paul Lightsey to write a computer program for the calculation of these quantities on the Apple IIe.

The two jumps performed by each of the eleven subjects were filmed at 24 frames per second with a Photo-Sonics camera. The film was digitized on a Vanguard Motion Analyzer. The centers of mass (com) locations of the subjects were estimated at three positions during their jumps. The three (com) positions were: (com1) when the subjects were at their lowest crouched positions; (com2) when the subjects were in an extended position just before their release from the floor; and (com3) when the subjects were at the highest

TABLE I

DATA OBTAINED WHEN SUBJECTS WERE NOT ALLOWED TO USE THEIR ARMS

SUBJECTS	TIME OF FLIGHT (SEC)	POWER (WATTS) FORCE-PLATFORM	POWER (WATTS) HEIGHT DATA
1	0.50	1844	1876
2	0.50	1305	1105
3	0.42	1257	1209
4	0.46	1288	1400
5	0.48	2055	2299
6	0.54	2082	2244
7	0.62	1819	1635
8	0.58	2299	2407
9	0.57	1865	1917
10	0.56	1628	1679
11	0.54	1705	1556

points in their jumps. The location of the subject's iliac crest was used as a reference for these approximations. The three (com) positions were used to calculate the following heights:

Y1: height of (com1) which was used as the reference height
Y2: height of (com2) above (com1)
Y3: height of (com3) above (com1)

The weight of each subject (mg) was measured and used along with the three heights to compute work, force, velocity, and power through the use of the Lightsey formulas. A computer program was developed by Kevin Spooner and Paul Lightsey for the calculation of these quantities on the Apple IIe.

RESULTS

The leg power score of each subject calculated through use of the Lightsey formulas using the height data are presented in Table I. Also shown in Table I are the leg power scores obtained for the subjects using data from the force platform.

The mean of the power scores calculated from the height data was 1740 watts and the mean of the power scores obtained from the force platform was 1757 watts. These means were within 1% agreement and the correlation between the two sets of scores was 0.95.

CONCLUSIONS

The high correlation and the amount of agreement of the two sets of power scores suggest that the Lightsey formulas for the approximation of leg power from height measures are valid.