PREDICTION OF 1 REPETITION MAXIMUM IN UNDERGOING HIGH-SCHOOL POWER LIFTERS IN AURANGABAD CITY

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Abstract

Twenty high school male power lifters performed 1-repetition maximum (1RM) and sub maximal strength tests (70, 80, and 90% 1RM) to develop prediction equations for the squat (SQ), bench press (BP), and deadlift (DL) exercises. For each equation, stepwise multiple-regression prediction procedure included the maximum number of repetitions (REPS) completed at a given %1RM weight (REPWT). For SQ and BP the 70% 1RM yielded the best 1RM prediction equations: (1RM SQ [kg]) = 159.9 + (0.103 x REPS x REPWT) + (-11.552 x REPS), with a standard error of the estimate (SEE) of 5.06 kg; (1RM BP [kg]) = 90.66 + (0.085 x REPS x REPWT) + (-5.306 x REPS), with an SEE of 2.69 kg. For DL the 80% 1RM yielded the best prediction equation: (1RM DL [kg]) = 156.08 + (0.098 x REPS x REPWT) + (-12.106 x REPS), with an SEE of 4.97 kg. The athlete's years lifted (number of years of power lifting experience) was highly correlated with the 1RM strength for BP and DL (r > 0.70) but not for SQ (r < 0.70). No bodily structural dimension variable had a significant correlation with 1RM strength (r < 0.70). The results of this study indicate that 1RM SQ, BP, and DL may be predicted with an acceptable degree of accuracy in elite male high-school power lifter subjects.

Introduction

Powerlifters, weightlifters, strength trainers, personal instructors and coaches, athletic trainers, rehabilitation specialists, and health and fitness professionals routinely use measurement of maximal strength as a guide to quantify the level of strength, assess the severity of injury or strength imbalance, and evaluate the effectiveness of a training or rehabilitation program. The 1 repetition maximum (1RM) test is the most frequently used strength procedure to evaluate the maximum weight an individual can lift once through the complete movement of an exercise. However, attempting the 1RM lift requires intense mental focus and physical readiness in the lifters. Novice lifters and weight trainers may find the 1RM test difficult because of an unaccustomed insecurity while handling heavy loads, inadequate spotting assistance, and fear of failure with the lift. Therefore, the purpose of this study was to develop prediction equations based

on sub maximal repetitions that best predict 1RM in SQ, BP, and dead lift (DL) exercises for high-school power lifters. A second purpose of this study was to determine which structural dimension variables best predict 1RM strength for this population.

Method of the Study
Sample

Twenty male power lifters between the ages of 15 and 18 were selected from high-school powerlifters. All subjects completed a medical examination and a physical before participation in the sport. A health history screening also was administered during pre test assessments. A signed permission form was received from each subject's parent or guardian before any testing began. Permission to conduct this investigation was obtained from the high-school principal and the School Management board.

Selection of Variable

The study was taken to pinpoint the maximum strength variable. Therefore, based on literary evidence and scholars own understanding the following variables were selected for the purpose of this study: Age (y), Height (cm), Weight (kg), Year lifted (y), Chest circumference (cm), Bicep circumference (cm), Bench drop distance (cm) and 1RM Bench Press, 1RM Squat and 1RM Dead lift.

Table 1.

Subject structural dimension descriptive. (N=20)

Variables	Mean $\pm SD$
Age (y)	16.3 ± 1.2
Height (cm)	173.9 ± 7.9
Weight (kg)	82.4 ± 21.9
Years lifted (y)	1.7 ± 0.97
Chest circumference (cm)	98.9 ± 14.0
Biceps circumference (cm)	33.1 ± 5.2
Bench drop distance (cm)	42.6 ± 3.4

Procedure of the study

Chest and biceps circumference was measured using a cloth tape measure with metric divisions. Height was measured with a meter stick taped against the wall. weight was determined using electrical weigh scale. Bench drop distance was measured with the arms extended, using a cloth tape, from the centre of the bar to the centre of the sternum, directly between the 2 nipples. During the testing, if more than 1 test was done on the same day for a particular lift, a rest period of 3-10 minutes was allowed. The judges had white and red flags, which they used to signify a good lift or repetition. When at least 2 of the 3 judges held up a white flag, the lift was accepted. For each testing session a proper warm-up protocol was used. Because testing occurred at the end of a powerlifting season, the subjects were allowed to determine their own preferred warm-up protocol.

One Repetition Maximum Tests

For the 1RM tests, each subject attempted a weight that he believed could be lifted only once using maximum effort. The subject then added weight in increments of 2.5 to 5 kg until the heaviest load that could be successfully lifted once was determined. The subjects rested for approximately 3-5 minutes between attempts.

Statistical Technique

Descriptive statistics is used for data analysis the researcher collected the data used by the accuracy of the regression equations was determined using a correlation coefficient.

Result of the study

The structural dimension characteristics of the subject population are presented in Table 1. Although the subjects had attained national stature as high-school powerlifters, they had an average of less than 2 years in the sport. Eleven subjects, or 61.1%, were considered first-year lifters, and all lifters trained under the same coach.

To establish the impact of structural dimension variables on 1RM strength, multiple-regression analysis and Pearson's correlation coefficient (r) were used. Two variables were considered to be highly related if the respective correlation coefficients were equal to or greater than 0.70. Table 2 presents correlations between the structural dimension predictor variables and the 1RM strength. The results indicate that only the years lifted (number of years of powerlifting experience) was highly correlated with 1RM strength in BP and DL.

Table no 2.

Correlation (r) between the structural dimension predictor variable and 1RM (the measured / repetition maximum) in squat, bench press, and dead lift (N=20).

Predictors	1RM Squat	1RM Bench press	1RM Dead lift
Age (y)	0.428	0.621	0.554
Height (cm)	0.015	0.336	0.137
Weight (kg)	0.389	0.531	0.370
Years lifted (y)	0.644	0.728*	0.765*
Chest circumference (cm)	0.386	0.527	0.425
Biceps circumference (cm)	0.386	0.576	0.462
Bench drop distance (cm)	-0.334	-0.276	-0.362

1 RM = 1 repetition maximum. P, Ã 0.05.

The results show that the estimated 1RMs derived from the regression equations were highly correlated with the actual SQ, BP, and DL performance. As specified in Table 3, the best predictors for SQ and BP were the Reps and Reps × Reps Wt performed at 70% 1RM. For the DL the best predictors were the Reps × Reps Wt and Reps performed at 80% 1RM.

Table 3.

Multiple-regression results ($N = 20$).

	Squat	Bench press	Dead lift
Best predictors	70% Reps × Reps Wt and Reps	70% Reps × Reps Wt and Reps	80% Reps × Reps Wt and Reps
$R2$	0.984	0.985	0.982
Adjusted $R2$	0.982	0.983	0.980
See (kg)*	5.06	2.69	4.97

See = standard error of the estimate.

70% Reps × Reps Wt and Reps = number of repetitions × weight lifted at 70% 1RM and number of repetitions at 70% 1RM.

80% Reps × Rep Wt and Reps = number of repetitions × weight lifted at 80% 1RM and number of repetitions at 80% 1RM.

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Table 4.

Repetitions performed based on best predictors of %1RM (*N* = 20).

	70% 1RM Squat	70% 1RM Bench press	70% 1RM Dead lift
Mean (repetitions)	13	16	12
SD	± 3.18	± 2.38	± 3.17
One *SD* range (repetitions)	10–16	14–18	9–14

1 RM = 1 repetition maximum.

Presents the mean ± *SD* and the repetition range of 68% (1 *SD*) of the subjects using the best Reps Wt predictor. Stepwise regression analyses produced the following equations to predict 1RM SQ and BP strength: (1RM SQ [kg]) = 159.9 + (0.103 × Reps × Reps Wt) + (211.552 × Reps) (the $R2$ value accounted for 98% of the variance, with a See of 5.06 kg); (1RM BP [kg]) = 90.66 + (0.085 × Reps × Reps Wt) + (25.306 × Reps) (the $R2$ value accounted for 98% of the variance, with a See of 2.69 kg.) The stepwise regression analyses produced the following equation to predict 1RM DL from Reps ×Rep Wt and Reps performed at 80% 1RM: (1RM DL [kg]) = 156.08 + (0.098 × Reps × Reps Wt) + (212.106 × Reps) (the $R2$ value accounted for 98% of the variance, with a See of 4.97 kg).

Discussion

The results of this study suggest that the estimated 1RM derived from the regression equations using Reps and Reps × Reps Wt as variables in the estimation equation was adequate for estimating 1RM strength for all lifts. This is supported by the accuracy of the 2 component equation developed in this study. The results of this study demonstrate a significant positive correlation between predicted and measured 1RM for SQ, BP, and DL in the 20 high school power lifting subjects. These results are consistent with the findings of studies that have attempted to predict 1RM strength from sub maximal strength tests in male subjects.

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