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Eccentric Weight Training Program: Six-Week Case Study

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ABSTRACT

ECCENTRIC WEIGHT TRAINING PROGRAM: SIX-WEEK CASE STUDY. CHARLIE HAIRE. JAF September 2005.

KEY WORDS: Negative-only (NO), Negative-accentuated (NA), Body Fat Percentage, Ectomorph, Mesomorph and Endomorph.

Negative only exercise was introduced to the strength training community in the 1970s, by Arthur Jones and with reportedly good success. During a six-week training session, eight high school football players were trained two times per week using a negative protocol that included both negative-only and negative-accentuated exercise. The overall average strength increase was 25%.

INTRODUCTION

The purpose of this study was to determine if a negative only based weight lifting program was a productive way to train high school athletes. Eight high school football players were tested for strength, measurement of body parts, and percent of body fat one week before the project. The project was conducted for six weeks with two workouts per week. Three days after the last workout, the athletes were retested, with the same measurements that were taken before the test begun.

The workouts consisted of six different exercises; five were performed negative-only (NO), one negative accentuated (raise the weight with two limbs, lower with one, NA). Only one set was performed. The set was terminated when the subject could no longer control the downward movement. The guide number of reps was eight except for chins and dips where the number was six. When eight reps could be performed, with each repetition taking ten seconds, the weight increased. The eight athletes showed an average overall strength increase of twenty-five percent.

Dr. Elliot Plese conducted a study in 1973 at Colorado State University using two subjects (1, 5). The subjects performed over half of the exercises in a negative only or negative accentuated fashion. The workouts were performed three times per week for twenty-eight days. One subjected gained forty-five pounds of body weight and doubled his leg strength. Colonel James Anderson oversaw a research study titled the West Point Project in 1975 (3, 4). Twenty-one cadets participated in a strength program that consisted of three workouts per week, for six weeks. The strength program consisted of negative-only, negative accentuated, and normal positive-negative exercises. The cadets overall strength increased sixty percent.

To this author's knowledge no research has been conducted using an all-negative or negative-accentuated protocol on high school athletes. Moreover, the two above research projects were referenced since they involved either athletes (football players) or advanced trainees, whereas other research often selected typical university students or the sedentary.

Is a negative based workout program performed twice per week capable of increasing strength (including concentric ability)? This study will attempt to answer that question. We also were interested in the effects, usefulness and practicality of the Negative Attitude equipment used in this study, which machines involve long lever arms for an instructor to lift the weight, whereas the trainee would lower the weight.

Further, the author has been a strength coach for 30 years, 20 of those years in the public school systems. High-intensity training (HIT) was always the method used in all conditioning classes. The average number of students was 30 with a high of 47 students one semester; supervision always was a concern in large classes. The average improvement per student was 10-15%, with the 15% improvement being the students who were supervised the closest. In this study each subject was supervised individually.

METHODS

Subjects

Eight High School football players were selected for their work habits. All of the athletes were involved in weight training for at least on year. Each athlete had demonstrated the ability to work hard. The body types were one ectomorph, three mesomorphs, and four endomorphs. Athletes ranged in weight from a 252.7-pound offensive guard to a 139.8-pound wide receiver.

Procedures

Dr. Tony Meador and Dr. Ernest Cohn administered a pre and posttest. The test consisted of seated blood pressure, pulse, and respiratory rate. The athlete was asked to jog in place for two minutes and the vitals rechecked. Measurements were taken at the neck, chest-across the nipples; both biceps flexed at right angles, waist at the belly button, both thighs nine inches from the knee, and the calves at the largest portion.

Grip strength was checked using a grip dynamometer. The athlete held the instrument in front of him with his arm straight. Three readings were taken. Tissue calcium was checked with a blood pressure cuff placed around the shin. The cuff was pumped up until the athlete complained of pain. Body fat and BMI were checked using a Bodylogic Body Fat Analyzer set on the athletic setting.

The strength test was done two days before the workouts were to begin. All strength testing was done using Hammer Equipment to eliminate skill from the test (as opposed to the balancing requirements of free weight exercises). All seat adjustments were noted and used in both the pre and posttest. The Hammer H-Squat was used to check lower body strength, the Hammer Behind the Neck Press for pressing strength, and the Hammer Front Pull-down was used to check pulling strength. The starting weight for the pre-test was selected based on workouts performed earlier. The subject performed the test, going to muscular failure on each of the three exercises, and weight and reps were recorded.

The post-test was administered three days after the last workout, again for a maximum number of repetitions with an appropriate weight. All medical testing and measurements were done on Monday and Tuesday, with the last workout having been performed on Friday. The strength test was conducted on Wednesday.

The workouts were scheduled twice per week, Monday and Thursday or Tuesday and Friday, for six weeks. Each workout consisted of one set of six different exercises, with two different workouts used. Negative-Attitude Equipment was used for all leg presses, pullover, rowing, and bench pressing (equipment with long lever arms that allows an instructor to lift the weight while the trainee lowers the weight). A Nautilus Multi Exerciser (OME) was used for chins and dips. The Hammer Neck Machine and Wrist Curl were used for those exercises.

The guide number of repetitions was eight on all exercises except chins and dips, where the guide number was six. Anytime the guide number was meet the weight was increased the next workout. For a repetition to be recorded, the weight had to be lowered in 8-10 seconds. A stopwatch with a verbal count was used. The set was terminated when the repetition was lowered in less than six seconds.

All exercises were performed in a negative only fashion with the exception of the rowing exercise. That exercise was done in a negative accentuated style: raise the weight with two limbs, lower the one.

Chart 1. Exercises

Workout A	Workout B
1. Hammer Neck (front and back) NO	1. Neg Att. Leg Press NO
2. Neg. Att. Leg Press NO	2. Neg Att. Bench NO
3. Neg. Att. Pullover NO	3. Neg. Att. Pullover NO
4. Neg Att. Row NA	4. Neg. Att. Row NA
5. Neg. Att. Bench NO	5. Dips (Nautilus OME) NO
6. Chins (Nautilus OME) NO	6. Hammer Wrist Curls NO

RESULTS

Chart 2. Average Results

	Pre-Experiment	Post-Experiment	Change
Body Weight	184.58 lbs (83.73 kg)	188.4 lbs (85.46 kg)	+3.81 lbs (1.73 kg)
Neck	14.75 in (37.47 cm)	15.67 in (39.80 cm)	+.92 in (2.34 cm)
Chest	36.57 in (92.89 cm)	37.85 in (96.14 cm)	+1.35 in (3.43 cm)
Biceps L	13.64 in (34.65 cm)	14.42 in (36.63 cm)	+.785 in (1.99 cm)
Biceps R	13.78 in (35.0 cm)	14.39 in (36.6 cm)	+.607 in (1.54 cm)
Waist	33.28 in (84.53 cm)	33.5 in (85.1 cm)	+.25 in (.635 cm)
Thigh L	23.85 in (60.58 cm)	24.17 in (61.4 cm)	+.392 in (1cm)
Thigh R	24.1 in (61.21 cm)	24.25 in (61.6 cm)	+.142 in (.361 cm)
Calf L	15.57 in (39.55 cm)	15.71 in (39.9 cm)	+.142 in (.361 cm)
Calf R	15.55 in (39.5 cm)	15.60 in (39.62 cm)	+.05 in (.13 cm)
BMI	25.37	25.41	+.04
Body Fat %	12.71 %	12.7 %	-.01 %
Grip L	65.7 lbs (29.80 kg)	86.65 lbs (39.30 kg)	+20.95 lbs (9.5 kg)
Grip R	70.4 lbs. (31.93 kg)	91.4 lbs. (41.5 kg)	+21.0 lbs. (9.53 kg)

Chart 2. Average Strength Test Results

Exercise	Pre-Experiment	Post-Experiment	Difference
H-Squat	343.75 lbs (155.93 kg) @ 24.1 repetitions	442.5 lbs (200.7 kg) @ 24.6 repetitions	+98.75 lbs (44.8 kg) (+29.19%)
Press	116.87 lbs (53.0 kg) @ 13.1 repetitions	139.37 lbs (63.22 kg) @ 11.1 repetitions	+22.5 lbs (10.21 kg) (19.32%)
Pulldown	140.0 lbs (63.5 kg) @ 13.1 repetitions	180.0 lbs (81.65 kg) @ 8.5 repetitions	+40.0 lbs (18.14 kg) (28.57%)

Chart 3a. Least Gains

	Pre-Exp.	Post-Exp.	Net
Body Weight	151.0 lbs (68.5 kg)	146.0 lbs (66.2 kg)	-5.0 lbs (-2.268 kg)
Body Fat %	14.7 %	17.3 %	+2.6 %
Neck	14.25 in (36.2 cm)	14.75 in (37.47 cm)	+.5 in (1.27 cm)
Chest	45.5 in (115.57 cm)	44.5 in (113.03 cm)	- 1.0 in (-0.45 cm)
Biceps L	13.25 in (33.66 cm)	13.0 in (33.0 cm)	-0.25 in (-0.635 cm)
Biceps R	12.75 in (32.4 cm)	13.0 in (33.0 cm)	+.25 in (+0.113 cm)
Waist	32.0 in (81.3 cm)	30.75 in (78.12 cm)	-1.25 in (-3.18cm)
Thigh L	28.5 in (72.4 cm)	28.0 in (71.12 cm)	-.05 in (-0.127 cm)
Thigh R	22.75 in (57.8 cm)	22.0 in (55.88 cm)	-0.75 in (-1.91 cm)
Calf L	13.0 in (33.0 cm)	13.0 in (33.02 cm)	0.0 in (0.0 cm)
Calf R	14.5 in (36.83 cm)	14.0 in (35.56 cm)	-0.5 in (-1.27 cm)
Grip R	111.0 lbs (50.35 kg)	106.6 lbs (48.35 kg)	-4.4 lbs (-1.99 kg)
Grip L	113.6 lbs (51.53 kg)	103.3 lbs (46.86 kg)	-10.3 lbs (-4.67 kg)

Chart 3b. Greatest Gains

	Pre-Exp.	Post-Exp.	Net
Body Weight	252.7 lbs (114.62 kg)	263.2 lbs (119.39 kg)	+10.5 lbs (4.76 kg)
Body Fat %	10.0 %	7.0 %	-3.0 %
Neck	17.0 in (43.18 cm)	18.0 in (45.72 cm)	+1.0 in (2.54 cm)
Chest	35.0 in (88.9 cm)	37.5 in (95.25 cm)	+2.5 in (6.35 cm)
Biceps L	13.0 in (33.02 cm)	14.5 in (36.83 cm)	+1.5 in (0.7 cm)
Biceps R	13.5 in (34.29 cm)	14.5 in (36.83 cm)	+1.0 in (2.54 cm)
Waist	32.0 in (81.28 cm)	33.5 in (85.09 cm)	+1.5 in (0.7 cm)
Thigh L	23.5 in (59.69 cm)	24.5 in (62.23 cm)	+1.0 in (2.54 cm)
Thigh R	22.0 in (55.88 cm)	23.0 in (58.42 cm)	+1.0 in (2.54 cm)
Calf L	17.5 in (44.45 cm)	18.0 in (45.72 cm)	+0.5 in (1.27 cm)
Calf R	15.5 in (39.37 cm)	16.0 in (40.64 cm)	+0.5 in (1.27 cm)
Grip R	45.0 lbs (20.41 kg)	115.0 lbs (52.164 kg)	+70.0 lbs (31.75 kg)
Grip L	37.3 lbs (16.92 kg)	105.0 lbs (47.63 kg)	+67.7 lbs (30.71 kg)

Chart 4a. Strength Improvement Least Gains

Exercise	Pre-Experiment	Post-Experiment	Improvement
H-Squat	400 lbs (181.44 kg) @ 7 repetitions	500 lbs (226.8 kg) @ 11 repetitions	+25 %
Press	115 lbs (52.2 kg) @ 5 repetitions	135 lbs (61.24 kg) @ 5 repetitions	+17.39 %
Pulldown	140 lbs (63.5 kg) @ 7 repetitions	180 lbs (81.65 kg) @ 6 repetitions	+28.57 %

Chart 4b. Strength Improvement Greatest Gains

Exercise	Pre-Experiment	Post-Experiment	Improvement
H-Squat	300 lbs (136.1 kg) @ 35 repetitions	400 lbs (181.44 kg) @ 31 repetitions	+33.3 %
Press	100 lbs (45.36 kg) @ 14 repetitions	125 lbs (61.24 kg) @ 11 repetitions	+25 %
Pulldown	140 lbs (63.5 kg) @ 16 repetitions	180 lbs (81.65 kg) @ 14 repetitions	+28.57 %

DISCUSSION

The overall strength gain for the eight athletes was 25.69%, while the average strength gain from the 'traditional' strength training classes I supervised in previous years ranged from 10-15%. However, it should be noted that the number of repetitions completed relative to the load in the pre- and post-tests were not identical (as weight increased, repetitions decreased), and the overall average gain of 25.69% may be a slight over-estimate. Nonetheless, it is possible that the strength gains could have been better if the optimum number of workouts was known; and the missed workouts (due to snow) could have aided the recovery of the athletes. Also, this research clearly indicates that positive/concentric lifting ability does increase with negative-only strength ability, and that one aspect is not a separate issue (or develops separately) from the other, as some strength and conditioning experts contend.

The Negative Attitude equipment performed well. It would be interesting to compare a negative only workout with Negative Attitude equipment to that of negative-accentuated exercise with Nautilus or Hammer equipment.

Lastly, how would the athletes' gains been if only one workout was followed rather than two? In such a short span (six weeks), the athletes may have gained better if the training had consisted of the A workout only; a consideration for future research.

CONCLUSIONS

After thirty years of teaching high school weight training in a high intensity fashion, I have learned to expect a 10-15% strength increase during a semester (16 weeks). The 15% improvement is generally from the students that are supervised the closest.

The negative workouts averaged 11 minutes per session. From a time standpoint, negative workouts are a very attractive way to train. In a high school setting, where having enough time to get everything done with athletes is a problem, negative workouts may be the answer.

The eight football players showed an average strength increase of 25% from nine negative workouts. Inclement weather forced the closing of school for several days, reducing the workout days from twelve to nine. The next step is to train a group for 16 weeks with a negative protocol and document the results. The next question to answer is at what point do the workouts need to be reduced from two times per week to three times every two weeks.

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