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A comparison of once versus twice per week training on leg press strength in women

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Aim. The purpose of this study was to compare strength differences between 2 groups of untrained women, who performed a single set of the leg press exercise once or twice per week.

Methods. Twenty-one women were divided randomly into 2 groups: Group 1 (n=10) performed a single set of the leg press exercise once per week, while Group 2 (n=11) performed a single set of the leg press exercise twice per week for a period of 8 weeks. Throughout the duration of the study, an amount of resistance was utilized that allowed for a single set of 6 to 10 repetitions to muscular failure. At the conclusion of the study, subjects were tested for their 6-RM strength. A 2x2 ANOVA was used to compare strength differences. The α level was set at 0.05 in order for differences to be considered significant.

Results. The 2x2 ANOVA demonstrated that strength increases were significant between tests ($P=0.0001$), but not significant between groups ($P=0.757$).

Conclusion. These results indicate that performing a single set of the leg press once or twice per week results in statistically similar strength gains in untrained women.

KEY WORDS: Strength - Training - Frequency - Muscle fatigue.

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Resistance training has been recognized as an integral part of a comprehensive fitness program. Resistance training has grown in popularity with individuals of all ages seeking benefits in health, appear-

ance, and physical function. For individuals with busy schedules, an exercise program that can be both efficient and effective is desirable.¹ Training frequency is one variable that contributes to both the efficiency and effectiveness of a resistance-training program.

The frequency variable is commonly defined on a weekly basis. Weekly training frequency may depend on factors such as workout volume and intensity, the muscle groups being trained, the exercises selected, the level of conditioning, and the ability to recover between workouts. For strength gains to occur, weekly training frequency must be sufficient to allow for recuperation without over-training. However, too much rest between workouts can result in detraining.

A common recommendation is to train each muscle group every 48 hours, which corresponds to 3 workouts per week. Studies have commonly compared training frequencies of 2 days versus 3 days per week in untrained subjects. Braith *et al.*² found that for the knee extension exercise, strength gains were greatest when training 3 days per week. However, Carroll *et al.*³ found that for the squat exercise, strength gains were not significantly different when training 2 days versus 3 days per week.

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TABLE I.—Mean comparison: Group 1 versus Group 2.

	N	Height (cm)	Body mass (kg)	Pre (kg)	Post (kg)
Group 1	10	171.96±5.36*	64.32±5.38	263.31±37.23	362.65±51.06
Group 2	11	168.16±7.25	64.35±8.46	244.89±45.80	391.53±45.18

* P≤0.05; Group 1: once per week; Group 2: twice per week.

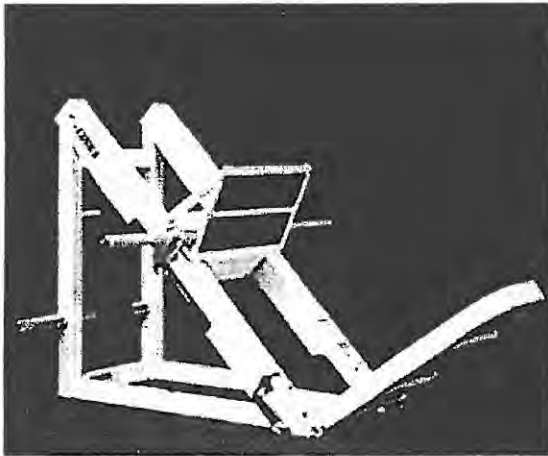


Figure 1.—Cybex 45 degree angled hip sled.

Other studies have shown that greater strength gains are possible when training more than 3 days per week. Gillam⁴ compared bench press strength in 5 groups of untrained high school students who trained 1, 2, 3, 4, or 5 days per week, and found that strength gains were greatest in the group that trained 5 days per week. Likewise, Hunter⁵ found that in untrained subjects, bench press strength was significantly greater when training 4 days *versus* 3 days per week.

For trained individuals seeking maximal strength gains, a higher intensity, volume, and frequency of training is necessary.⁵⁻⁹ However, for untrained individuals seeking strength gains for the purpose of improving health and physical function, a lower intensity, volume, and frequency of training might be sufficient.^{6, 10} Prior studies have demonstrated similar strength gains in untrained subjects who performed a single set to muscular failure once or twice per week. However, these studies only included men and examined exercises that involve single muscle groups, such as the lumbar or cervical extensors.¹¹⁻¹⁴

Few studies have included women and examined exercises that involve multiple muscle groups, particularly those muscle groups of the lower body. Therefore, the purpose of this study was to compare strength differences between 2 groups of untrained women, who performed a single set of the leg press exercise once or twice per week. The leg press exercise was selected because it involves multiple muscle groups and is commonly performed during the early stages of a strength training program.¹⁵ Based on the findings of previous studies, we hypothesized that the twice per week group would demonstrate greater strength gains than the once per week group.

Materials and methods

Twenty-one apparently healthy women who were students at Utah State University were recruited for this study. All subjects were screened for a history of cardiovascular disease, orthopedic problems, and any other medical conditions that would contraindicate resistance exercise. All subjects were considered untrained lifters, having performed little or no strength training prior to this study. Prior to data collection, the methods and procedures used in this study were reviewed and approved by the Institutional Review Board at Utah State University. Documented informed consent for testing and training was obtained from all of the subjects.

After consent was obtained; subjects were divided randomly into 2 groups. Descriptive characteristics for each group are presented in Table I. Group 1 (n=10) performed the leg press once per week, while Group 2 (n=11) performed the leg press twice per week for a period of 8 weeks. The workouts for the twice per week group were separated by 72 hours (*i.e.* Tuesday and Friday). The model of leg press utilized was a Cybex 45 degree angled hip sled, in which plates were loaded on each side of a foot platform (Figure 1). The resistance imparted without plates was 20.5 kg.

Prior to beginning the study, 2 testing sessions, separated by 1 week were used to familiarize the subjects with the procedures and to determine initial strength levels. Subjects were tested for their 6 repetition maximum (RM) strength using previously described procedures.¹⁶ A 6-RM was tested due to concerns with testing maximal strength in subjects with little or no previous resistance training experience. Data obtained from the initial testing sessions was used to determine an appropriate starting resistance for Week 1 of the study.

Subjects were supervised by the same two individuals during each scheduled workout. During each workout, subjects performed a warm-up that consisted of 5 minutes of light aerobic activity followed by one warm-up set at 50% of the goal resistance for 10 repetitions. Following a 3-minute rest period, the resistance was then increased to 100% of the goal resistance, and 6-10 repetitions were attempted to the point of concentric failure.

When subjects were able to exceed 10 repetitions, the resistance was increased 18.2 kg during the next scheduled workout. Subjects were verbally encouraged to continue lifting until another repetition was impossible to perform. The same spotter was utilized for all sets to ensure that proper technique was maintained and to assist in racking the resistance. For each repetition of the leg press, subjects descended to a point where the tops of the thighs were perpendicular to the floor.

To reduce the risk of injury and to control the momentum of the mass, a slow and controlled lifting cadence of 4-0-4 was maintained for all repetitions with 4 seconds to descend to the bottom position and 4 seconds to ascend to the beginning position, without pausing at the bottom. To ensure that subjects were consistent in following the repetition cadence, all sets were timed using a hand-held stopwatch. At the conclusion of the study, subjects were once again tested for their 6-RM strength.

Statistical analysis

Subjects were required to attend 90% of all workouts in order to be included in the data analysis. Additionally, all subjects agreed not to perform any other strength training throughout the duration of the study. The SPSS statistical software was used for the data analysis. A paired *t*-test was used to compare differences in height, body mass and initial strength between groups. Reliability of the initial strength tests

was assessed for each group separately. At the conclusion of the study, a 2x2 ANOVA was used to assess strength differences between testing sessions (pretest/post-test) and between groups (Group 1/Group 2). The α level for all statistical comparisons was set at 0.05 in order for differences to be considered significant.

Results

All 21 subjects met the attendance criteria for inclusion into the data analysis. The paired *t*-test demonstrated that Group 1 was significantly taller than Group 2 ($P=0.047$), but not different in terms of body mass ($P=0.990$) or initial strength ($P=0.174$; Table I). The reliability analysis demonstrated that the relationship between the initial strength tests was reasonably consistent (Group 1=0.86; Group 2=0.84). The 2x2 ANOVA demonstrated that strength increases were significant between tests ($P=0.0001$), but not significant between groups ($P=0.757$). A significant interaction was found between test time and group ($P=0.035$).

Discussion

The purpose of this study was to compare strength differences between 2 groups of untrained women, who performed a single set of the leg press exercise once or twice per week. We hypothesized that the twice per week group would demonstrate greater strength gains than the once per week group. Our hypothesis, however, was rejected, and both groups demonstrated statistically similar strength gains. The lack of significant differences was likely due to the large variability within groups (Table I). The large standard deviations within groups indicated that some of the subjects in Group 1 (once per week) made larger strength gains than some of the subjects in Group 2 (twice per week).

These findings were consistent with Graves *et al.*¹¹ who compared lumbar extension strength in untrained subjects who trained once per week (1X/week), twice per week (2X/week), or 3 times per week (3X/week) for 12 weeks. All groups performed a single set to muscular failure at their respective frequencies. Results demonstrated no significant differences in dynamic or isometric lumbar extension strength between the 1X/week group, the 2X/week group, and the 3X/week group. The percentage improvements for each group were as follows: 1X/2 weeks (26.6%), 1X/week

(38.9%), 2X/week (41.4%), and 3X/week (37.2%). Due to the potential for over-training associated with training 2 or 3 times per week, the authors concluded that training different muscle groups once per week may provide the safest and most efficient frequency of training for untrained lifters.

The findings of the current study were also in agreement with Taaffe *et al.*,¹⁰ who compared strength gains in older adults who trained once per week (1X/week), twice per week (2X/week), or 3 times per week (3X/week) for 24 weeks. The results demonstrated that strength gains were not significantly different between groups. The average percentage improvement for all exercises combined was 37% (1X/week), 41.9% (2X/week), and 39.7% (3X/week). Taaffe *et al.* concluded that a once weekly resistance-training program was as effective as and more efficient than higher frequency programs for reducing the risk of falls in older adults.

In the current study, the lack of significant differences between groups was somewhat surprising considering that the total volume lifted was not equalized. The total volume lifted (mass \times repetitions) over 8 weeks was nearly double for Group 2 (37 645.68 kg) versus Group 1 (20 060.1 kg). A possible explanation for the lack of significant differences might be the relatively short duration of the study.

In a 12 week study by McLester *et al.*,¹⁷ training volume was equalized, and strength gains were significantly greater in subjects who trained 3 days versus 1 day per week. To equalize training volume, the one-day group performed 3 sets, while the 3 day group performed one set for each of 9 exercises. For the upper and lower body exercises; the one-day group achieved approximately 62% of the strength gained by the 3-day group.

Both groups in the current study demonstrated large increases in strength, which was not surprising considering that subjects had little or no previous training experience. Subjects in Group 1 improved strength 38%, while subjects in Group 2 improved strength 60%. Due to the relatively short duration of the current study, these strength gains were likely due to neural adaptations rather than muscular hypertrophy.¹⁸ These improvements were similar to those noted in prior studies that compared strength gains in untrained subjects.

Pollock *et al.*¹³ found that a single set of lumbar extensions performed once per week for 10 weeks increased dynamic strength 61%. Likewise, McLester

*et al.*¹⁷ found that leg press strength increased 46% in subjects who performed one set 3 days per week for 12 weeks. Lastly, Braith *et al.*² found that dynamic leg extension strength increased 55% in subjects who performed one set 3 days per week and 45% in subjects who performed one set 2 days per week for 18 weeks.

As reported, a significant interaction was found between time and group ($P=0.035$). This indicated that over the first 4 weeks of the study, the once per week group made greater strength gains, but over the last 4 weeks of the study, the twice per week group made greater strength gains. Perhaps if the study had been conducted over a longer duration, differences between the once per week and twice per week groups would have reached significance.

Conclusions

The results of the current study are encouraging for untrained women who do not have a lot of time to devote to resistance training due to schedule related time conflicts. Large improvements in lower body strength were demonstrated consequent to performing a single set of the leg press exercise once or twice per week ($P=0.0001$). From a statistical standpoint, the differences between the once per week group and the twice per week group were not significant ($P=0.757$). However, from a practical standpoint, the percentage of strength gained by the twice per week group (60%) was higher than that gained by the once per week group (38%). Therefore, individuals with performance related goals, such as athletes, might consider performing the leg press exercise two or more times per week. It should be noted that these results are applicable only to the leg press exercise, and different exercises may require longer or shorter inter-session recovery intervals.

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